

# OSCILLATIONS, WAVES AND OPTICS

Fall 2021

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<b>Instructor:</b>	Prof. Shaon Ghosh	<b>Time:</b>	Tu/F 11:15 am – 12:30 pm
<b>Email:</b>	<a href="mailto:ghohsh@montclair.edu">ghohsh@montclair.edu</a>	<b>Place:</b>	Richardson Hall 256

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## Course links:

1. Official Course page: <https://montclair.instructure.com/courses/143096>

## Office Hours:

- Monday 2:00 pm - 4:00 pm
- Thursday 2:00 pm - 4:00 pm

## Text book:

- George C. King, *Vibrations and Waves*, John Wiley & Sons, Ltd., Publications

**Description of the course:** PHYS 220 is one of your first two post-introductory level physics courses in the undergraduate curriculum. This course requires a good understanding of the material you came across in PHYS 192. Thus, it is very important that you review the following materials from your PHYS 192 book as part of preparation for this class, oscillations, waves, sound wave, and light. We will be studying these concepts in more details in this course. Our first goal will be to understand the concepts of oscillations which is a kind of periodic motion. For mathematical treatment we will confine our focus on a special class of oscillations called simple harmonic motion (SHM). We will learn what characterizes these motions and how to use the concepts of SHM to understand the behavior of different systems. We will then move to the discussions of different modifications of SHM like damping and forced oscillations, and finally coupled oscillations. We will then study waves and its propagation, traveling waves and standing waves. Finally, we will wrap up the semester with the discussion on properties of waves, like dispersion, interference and diffraction.

One of the most important things that we will learn in PHYS 220 is the various techniques of solving differential equations. It is important that you understand these techniques, not only to be successful in this course, but these techniques will be indispensable in your later more advanced courses.

**Prerequisites:** Solid understanding of calculus is very important. You should not find integration of simple trig functions challenging. If you struggled with calculus in your math courses, and/or you are not confident about your PHYS 191 and, most importantly, PHYS 192, then please pay extra care in reviewing it. I will be happy to discuss your doubts and confusion. More basic math like trigonometry, linear algebra, and the concepts of radians and degrees are vital for any higher level physics. **Please meet me in the office hour early in the semester if you want me to go over this.** If you have weakness in the above mentioned topics of mathematics, you will find this course, and *especially* future physics courses extremely difficult, so it is highly important that you identify your weakness right now, and work on it with me. It might take you a month (depending upon where you are right now) to get up to speed, but will save you from a lot of frustrations in the future. Finally, concepts of vectors, though not that crucial in this course, is always handy and there might be some problems that will require some knowledge of vector analysis.

**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. On the due date of the homework I will be supplying you with complete solutions to all the problems. Your grades will be based on your quality of submission (full points if you have **properly** attempted the problems), not correctness. Properly attempting means, you have not submitted a blank page, or just copied the questions itself without any thought going into it. However, expect the questions in the test to be extremely similar to the homework problems. So, if you were unable to solve the problems correctly in the homework, it is important that you study the solutions I hand out.
2. **Quizzes:** Quizzes are in class component of this course. 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 two lowest scoring quizzes and one lowest scoring homework will be dropped from your final grades calculation. This is to protect you against occasional poor performances or slip-ups.

- **Exams:** There are going to be two types of tests in this course. The first type is the conventional exam, which includes **two midterms** and **one final**. Exams will be closed books, but I will provide you a sheet of formula required for the exam. Midterms will be based on the material covered before that midterm and after the previous midterm. The final exam will be based everything taught during the semester. **Barring extenuating and documented circumstances there will be no opportunity to retake the exams or to take it on another day.** So, please make sure not to miss the exams.

The second type of exams during the course will be called **mini-exams**. These are short exams announced a week in advance focusing on a specific topic. These will be 30 mins long and we will have that in the first part of the class. The first of these exams will be held after the first week of the class, focusing on your knowledge of PHYS 192 (Oscillations and waves). I will be dropping the lowest one or two (depending upon how many we end up having in the course) of the mini-exams.

You should bring your own pen/pencil during the exam. Normally, you will not need a calculator, but if it is required, I will let you know in advance. Use of any kind of phone or tablet is strictly forbidden, even in a calculator-mode when calculators are allowed.

- **Class participation:** Class participation includes your attendance, interactions during the class, and overall involvement during the course.
- **Extra credits:** There might be opportunities to score extra credits. This can boost your grade in the class, or help you compensate for missed assignments.

**Grading Policy:**

- Homeworks = 5%
- Quizzes = 15%
- Mini-exams = 20%
- 1st mid-term = 15%
- 2nd mid-term = 15%
- Final exam = 25%
- Class participation = 5%
- Extra credits.

**Important Dates:**

Midterm #1 .....	Oct 8, 2021
Midterm #2 .....	Nov 12, 2021
Final Exam .....	Dec 17, 2021

**Course policy and expectation:**

1. Phones, tablets and laptops are **not allowed** during the lectures, or at any time during the class. This includes note taking devices. I will call you out if I see you in violation of this. If the behavior persists, I will report you to the Dean of Students.
2. Students are expected to follow all MSU policies regarding harassment, bullying, plagiarism, and computer usage. We all in this course must treat each other with respect.
3. Maintain academic atmosphere in the class. Do not engage in personal discussion with your classmates while the class is in progress. This not only disturbs me but also your classmates.
4. Attendance at every lecture is not required but will be encouraged via pop quizzes and class-participation points. Kindly arrive for lecture on time.
5. Be prepared for class. Text readings, if they are assigned should be completed before class to maximize understanding. The in-class quizzes will occasionally have questions from the reading assignments.
6. Collaboration policy: you can of course discuss homework problems with your classmates, but you must understand and complete the assignment independently. Please remember that the homeworks will be graded not based on correctness but based on your attempt. Also, note that the homeworks constitute two of the smallest components of the course, hence has minimal impact on your grades. The only reason the homeworks are important are because similar questions from homeworks will be given in the exams. Late submission of homeworks are not possible in this class due to the following reasons:
  - I will be emailing the entire class solutions right after the due date. If someone requests extension it will make everyone else wait for the solution.
  - There is no reason for you to delay submission of the homeworks, since you do not have to get the solutions absolutely right. You need to make an honest attempt, and if I'm satisfied I will give you full score.

- Homeworks constitutes only 5% of the final grade, so it will have very little effect on your final score.
  - I will drop the least scoring homework for every student.
7. 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. You are not allowed to bring books during the exam. Use of any electronic gadget is prohibited in the exam.
  8. Class participation credit (aside from attendance and engagement in discussions) will be assigned generously based on compliance with the above policies. You will get a zero in this category if you violate the aforementioned course policies.
  9. 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.