

# Fall 2017 Physics 151 Syllabus

**Lecture:** Mon Wed Fri 12:00pm-1:05pm, Oxford Science Building 217

**Lab:** Tue 9:45am-12:45pm, Oxford Science Building 217

**Instructor:** Thomas Osburn (tosburn@emory.edu)

**Office:** Oxford Science Building 202

**Office Hours:** Tue 4:00pm-5:30pm, Fri 2:00pm-3:30pm (or by appointment/when door is open)

**Student tutoring location:** OSB Nucleus (second floor lobby)

**Student tutoring hours:** 7pm-9pm Tue (Isabella), Wed (Tianshu), Thur & Sun (Olivia)

**Textbook:** "Physics for Scientists and Engineers" 9<sup>th</sup> ed. by Serway and Jewett

The purpose of this course is to study physical interactions between matter and to quantify the influence those interactions have on how things move. Understanding these interactions will empower you to make accurate predictions about the world around you (e.g., hydraulic brakes, the mechanics of bridges, etc.). Accurate scientific predictions are the driving force behind technological developments that shape modern society. In particular, physics breakthroughs have been responsible for the industrial revolution, the age of electricity, computers, and more! This course will also help you appreciate how physics concepts are constantly being used in other sciences (i.e., chemistry, biology, geology, etc.). Finally, mastery of introductory physics will amplify your critical thinking and problem solving skills.

## Goals of the Course

At the end of this course, we will be able to:

1. Explain the basic concepts, theorems, and principles of physics (and when they apply)
2. Recognize the limitations of these physical models (where the assumptions break down)
3. Apply these models to solve both simple and advanced (i.e., multiple-step or multiple-concept) physics problems by learning how to
  - a. Deconstruct (i.e., break down) a big problem to its component "mini" problems
  - b. Identify and analyze which scientific models apply to each "mini" problem
  - c. Reconstruct the overall solution by combining results from the "mini" problems
  - d. Think critically about whether your final answer is reasonable relative to the concepts you have learned
4. Develop an organized and systematic solution to a problem
5. Integrate multiple concepts/principles when analyzing a complex phenomenon
6. Recognize how physical models apply to our day-to-day experiences
7. Begin to develop the quantitative and modeling skills used by scientists and engineers
8. Understand the questions physicists ask and the tools they use in order to discover knowledge in this field.

Remember that **knowing how to use calculus and using calculus is NOT the same as understanding the underlying concept/principle/theorem. In this class you will be asked to do both!**

To achieve these goals, we will solve many problems, use laboratory exercises, and discuss real-world applications while employing the mathematical tools of algebra and calculus in the process. We will be covering a lot of important concepts/principles/theorems during this semester. For this reason, you will have daily and weekly assignments and frequent quizzes.

**Student work submitted as part of this course may be reviewed by Oxford and Emory faculty/staff for the purposes of improving instruction and enhancing Emory education.**

Homework: All homework assignments and other announcements and handouts will be posted on Canvas. Therefore, **you are expected to check Canvas at least once a day**. Omission on your part to do so will not be regarded as a valid excuse for not completing an assignment. Homework assignments will be of three different kinds:

- a) **Daily reading:** After each class, I will assign the reading that you are REQUIRED to do BEFORE coming to class the next time. The reading will consist of sections from the textbook and my class notes that are already posted on Canvas. **I will be asking for your oral responses during class.** By doing the reading before coming to class, you will be better prepared to follow the discussion that will take place in class.
- b) **Daily practice problems and review questions:** At every lecture, you will be assigned a couple of problems and questions from the handout "Review Questions and Practice Problems". These problems will be much simpler than the Advanced Problems described in part (c) below (remember that these practice problems were written for the Physics 141 students). Thus, you should be able to do these problems before attempting the Advanced Problems described in (c) below. Use sheets of paper for the problems and keep them in a binder. I will be randomly collecting your solutions to the assigned practice problems (but not the answers to the review questions). Submission of the solutions to the assigned problems will count towards your Practice Problems grade (see section on Grading below).
- c) **Advanced problems:** Each week I will also be assigning a set of five advanced problems. The due date of each set will be announced under the "Assignments" tab on Canvas. I will be collecting one or more of the problems in each set on the due date. Understanding how to do these problems will help you in preparation for the tests, as the tests will have problems of the same level of difficulty as these advanced problems. Submission of these problems will count towards your Advanced Problems grade (see section on Grading below).

Notice that there are many *daily* assignments. **The goal is to be looking at the material as often as possible so that you can actually learn it.**

Quizzes: There will be frequent quizzes on the material that was discussed in the lectures and homework assignments. Quizzes cannot be made up: If you miss class the day when a quiz is taken, then you will not receive a grade for that quiz. Just as with the homework assignments, my goal is to ensure that you review the material frequently. You cannot possibly learn a concept/principle/theorem if you see it only once.

Tests and Exams: There will be three tests and one final exam (for dates, see below). The tests will be on the material discussed up until that point (the second test will cover the material after the first test and, similarly, the third test will be on the material after the second test). The final exam will be cumulative. There is no such thing as a make-up test/exam!

Re-grading Assignments: I am very careful when I grade assignments. However, I might make mistakes when I grade. If you would like me to re-grade a test/quiz/assignment, your request should be submitted to me **in writing within 24 hours** from the time I give back the graded assignment. Note that such a request will result in me re-grading the whole assignment/test/quiz (not just the specific problem you requested).

Attendance: I find attendance and class participation to be vital for your learning in this course. You will find the homework to be really easy to do, if you come to class and you actively participate by asking and answering questions. You are allowed **3 absences regardless of whether you have a valid reason for them or not**. Therefore, I recommend that you save those for when you really need them (e.g., you get sick) instead of skipping class. If you exceed the 3 absences, there will be a 5% deduction off of your final grade for every additional absence. **ATTENDANCE IS MANDATORY FOR LAB SESSIONS.**

Tardiness and classroom distractions: Being late for a class, or having your cell phone ring in the middle of one, is distracting not only for you but also for me and for your classmates. Students who are late for class for more than 5 min will generally be considered absent. Food and drink is not allowed in class, with the exception of a bottle of water.

Grading: Grades are assigned on the plus-minus scale. The final grade will be determined based on the following weighting:

**Practice problems and review questions: 5%**

**Advanced problem sets: 10%**

**Quizzes: 15%**

**Exam 1: 10%**

**Exam 2: 10%**

**Exam 3: 10%**

**Final Exam: 20%**

**Labs (lab questions, report): 20%**

Course Content: Mechanics, Wave Motion, and Thermodynamics

Important dates: Make sure you include these important dates in your planner/calendar. The actual times for the three tests will be determined but they will be out of class, on Friday afternoons.

Date	Description
Sept. 15, 2017	Test 1
Oct. 13, 2017	Test 2
Nov. 17, 2017	Test 3
Thurs, Dec. 7, 2017, 7:00pm-10:00pm	Final exam: Cumulative

Working with the Honor Code: The Oxford College Honor Code applies to this course as follows:

**Quizzes, tests, and final exam:** The work presented in these assignments should be your own. No collaboration permitted. You are expected to follow the instructions given by me and abide by the Honor Code. Sharing calculators, pencils, etc., is not allowed.

**Lab report, lab project:** On these assignments you can only collaborate with your lab partner.

**Advanced problems and Practice problems and review questions:** You are encouraged to work on the assignments **by yourselves first, before consulting others (classmates, tutor, me, etc.) for help.**

**Study groups:** Even though you cannot work together on quizzes, tests, and exams, you are definitely encouraged to form study groups and study concepts together and explain to each other things about which you were not clear from class or from your reading assignments. However, as

mentioned above, you are strongly encouraged to work on the homework assignments by yourself first, before consulting your classmates for help.

Religious Holidays: You need to tell me immediately if any religious holidays, other than the school holidays, will interfere with the course, especially the final exam and tests.

## How to Solve a Physics Problem

Your homework assignments will consist of pre-lecture reading assignments, review questions and practice problems, and advanced problems. In your solutions to all problems (tests, practice problems, etc.), I expect to see that you solve the problems following several important steps. **This is the proper methodology for solving a physics problem and this methodology is the same for all problems!**

Following these steps will ensure that you are learning how to approach a problem and how to develop an organized and methodical solution to a problem (see section **Goals of the Course**).

1. **Read the problem** carefully so that you know what is given and what is asked.
2. **Draw a picture.** I cannot think of any physics problems that can be solved without drawing a good picture.
3. **Label all the quantities** in the diagram, those that are given and those that you need to find. Also, **show your coordinate system and show which direction you have defined as positive!**
4. **State the Physics Laws/Principles/Theorems** that apply to that problem and explain why. Here, I am not asking for an essay, a sentence is enough. For example: "No external forces act on the system → Conservation of Momentum applies."
5. **Write the law in equation(s) form.** To continue the example, at this point you will say:  $\vec{P}_{final} = \vec{P}_{initial}$
6. **Solve** the equations and substitute the values. **Always include the units in your calculations!** Also, **show your work!** You cannot just write the initial equation and then the result. You have to show me the intermediate steps. This way, I can identify the wrong step and help you understand why what you did is not right.
7. **Check your answer.** Do the units match? Does the sign in front of your result make sense? Is the answer too big or too small compared to what you expected?

## Requirements for the Lab portion of this course

As noted above, the lab portion of the course constitutes 20% of your grade. Your student account will be automatically charged (less than \$10) for the lab manual. For the lab portion of the course the requirements are as follows:

1. Bring your lab manual: You will be given the lab manual at the beginning of the semester. You are expected to have read the lab handout for each week's lab BEFORE coming to the lab. Don't be surprised if there is a pre-lab quiz!
2. Answer all the questions in the lab handout: Some of these questions will require that you spend time at home analyzing the data and drawing graphs. ALWAYS bring the answers to those questions in next week's lab for me to check. This will count towards your lab grade.
3. Understand the lab: Experiments require repetition in order to ensure that your data is reproducible. Sometimes students regard this repetition as "busy work". However, remember that at all times you need to be thinking about what your data means, if this is what you expected and why (or why not) and, also, what the reproducibility (or lack of) means. Essentially you are expected to be thinking about what conclusions you can draw from your data. Again,

don't be surprised if there is a post-lab quiz to ensure that you have understood the data and the purpose of the experiment. Any pre- and post-lab quizzes will count towards your lab grade.

4. A full lab report (the due date will be announced). For one lab experiment (I will announce which one) you will have to do one full lab report. I will give more detailed handouts on what a proper scientific lab report should look like when the time comes. The lab report will be corrected and graded and detailed comments will be given. If you desire, you can resubmit the lab report (after addressing all the comments) and the lab report will be re-graded, erasing in this way the first grade. You can only resubmit the lab report once.
5. Towards the end of the semester you will have a choice of a) either doing another full lab report (on a different lab experiment of your choice, this time) or b) doing a small final project. For the final project you will have to pick a topic and, using physics concepts you have learned throughout the semester, you will have to explain how something works during a 15min oral presentation. As an example, a topic can be "How do rockets fly?" Depending on your preference (how many people decide to do the presentations) we will have the last lab section of the semester devoted to the presentations. The final projects will be group projects (groups of two).

## Lab Schedule

The experiments we will be conducting this semester are on the following topics. Additional experiments might be added if time permits.

**Lab 1:** Class and pre-test

**Lab 2:** Instantaneous vs. Average velocity

**Lab 3:** Free fall

**Lab 4:** Projectile motion

**Lab 5:** Composition and Resolution of Forces

**Lab 6:** Newton's Second Law

**Lab 7:** Conservation of Mechanical Energy

**Lab 8:** Ballistic Pendulum

**Lab 9:** Torque and Equilibrium of a Rigid Body

**Lab 10:** Moment of Inertia

**Lab 11:** Archimedes' Principle

**Lab 12:** Wave Resonances in Air Columns

## **Acceptable and unacceptable class/lab behavior**

For our class and lab you are expected to

- a) have done the reading and homework problems (i.e., you are expected to come prepared),
- b) have all the things you will need during class and lab (your notebook, binder with the solved homework problems, calculator, lab manual, office supplies, etc.),
- c) pay attention and take notes.

There are certain things that I have observed students do during class and lab that I find unacceptable. In those cases I ask the students to leave the classroom or laboratory and I count them as absent.

### **You cannot:**

- a) come to class/lab without having done the reading and homework problems,
- b) come to class/lab without your notebook, binder with solved problems, calculator, lab manual, office supplies, etc.,
- c) eat during class/lab,
- d) drink during class and lab (except for water),
- e) not pay attention by sleeping or being distracted,
- f) distract other students,
- g) text during class/lab.
- h) be late for class/lab more than 3 minutes,
- i) be disrespectful.

If you need to leave the classroom or laboratory for any reason, you should avoid being disruptive and distracting. Try to leave the class/lab quickly and with as little noise as possible. You should not have to leave the class/lab more than once.

**This syllabus is subject to change at the discretion of the instructor.**