Fall 2016 Physics 151 Syllabus

Lecture: Mon Wed Fri 12:00pm-1:05pm, Oxford Science Building 217
Lab: Tues 9:45am-12:45pm, Oxford Science Building 217
Instructor: Thomas Osburn (tosburn@emory.edu)
Office: Oxford Science Building 202
Office Hours: Tues and Fri 2:00pm-4:00pm (or by appointment, or whenever my door is open)
Textbook: "Physics for Scientists and Engineers" 9th 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 the motion of bodies. Understanding these interactions allows people to predict the behavior of physical systems in nature. The power of accurate scientific predictions (such as the predictions you will learn to make in this class) is the driving force behind the technological developments that shape modern society. In particular, physics breakthroughs have been responsible for the industrial revolution, the age of electricity, computers, and more.

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 main 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
    e. Develop an organized and systematic solution to a problem
4. Apply calculus in order to solve advanced problems and gain insight into physics
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

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 many important concepts/principles/theorems during this semester. For this reason, you will have daily and weekly assignments and quizzes. To further strengthen your problem solving skills a fraction of lecture time will be spent solving problems in groups on portable white boards.

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

Course information

Prerequisite: Math 111 and Math 112 (Math 112 can be taken concurrently).

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. There are many different types of homework assignment:

a) **Daily reading:** You will be assigned (through Canvas) required reading from the textbook to be completed before each class.
b) **Daily video:** You will be assigned (through Canvas) a video that you are required to watch before each class. By watching the video before coming to class you will be better prepared to follow the discussion that will take place in class.
c) **Warm-up quiz:** Each daily video and reading will have a corresponding quiz on Canvas due 10 minutes before the start of class. The quizzes are short and have a 10 minute time limit. The purpose of the quiz is to motivate you to watch the video and read the textbook, and also to inform the instructor about strengths and weaknesses of the class.
d) **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 (e) 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 (e) 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).
e) **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).

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.

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. You cannot make up a test for an unexcused absence.

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).

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: 10%
Advanced problem sets: 10%

Quizzes and participation: 10%
Exams: 10% each test (30% total), 20% for the final
Labs (pre-lab and post-lab quizzes, lab questions, report, project): 20%

Attendance: 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**. If extreme hardship forces your absence please contact me.

Course Content: Mechanics, Wave Motion, and Thermodynamics

Important dates: Make sure you include these important dates in your planner/calendar

Date	Description
Sept. 16, 2016	Exam 1
Oct. 14, 2016	Exam 2
Nov. 18, 2016	Exam 3
Dec 13, 2016 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: Please inform me of any religious holidays that require your absence (other than school holidays) especially if they fall on final exam or test days.

Requirements for the Lab portion of this course

As noted above, the lab portion of the course constitutes 20% of your grade. 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. 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. Pre-lab and post-lab quizzes count towards your lab grade.
4. 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 could 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