Physics 111 Course Information

Contact

You can reach Prof. Peter Meyers in his office, 316 Jadwin Hall, by phone at 8-5581, or by email at meyers@princeton.edu. Changes of precept or lab are handled by the course managers Charlotte Richick and Martin Kicinski in the Physics Department office, 208 Jadwin. They can be reached at 8-4418 or uphysics@pupgg.princeton.edu. Other contact information can be found on the Physics 111 website.

Website

Much of the logistics (staff, contact info, schedules) and documents (homework assignments, lecture notes) will be found on the course website. This can be accessed through the University Blackboard system or directly at http://www.hep.princeton.edu/~meyers/p111/

Let Prof. Meyers know if you have any trouble seeing the site or downloading from it.

Goals and syllabus

Physics is the description of the behavior of objects and the understanding of that behavior at the most fundamental level possible. It is one of the triumphs of human thought that the understanding of everyday objects can lead to ideas valid throughout the universe, from scales much smaller than an atom to much larger than a galaxy. In exploring and extending our understanding, physics has come across phenomena both practical and mind-boggling.

The success of physics, and of science in all fields, in the past centuries has not been without cost (intellectual and in real dollars). The subject is now quite specialized, very technical, and highly mathematical. This can create a barrier between the excitement of scientific discovery and those who do not have extensive technical training. Yet, the fascination remains.

The centerpiece of Physics 111 will be the physical revolutions of the 20th century: relativity and quantum mechanics. Even those who have a passing familiarity with these ideas can’t imagine how strange they really are. Our goal is not only to introduce to you the oddity of all this, but to have you understand why we believe this to be a valid description of nature. We must start with the revolutions of Galileo, Newton, and Maxwell that gave us classical physics, not only to contrast the world of modern physics with the classical, but because we must develop the patterns of thinking that successfully managed these revolutions. To do this in one semester is a tall order.

Our approach will be to show you as much of this as possible and to extract the few powerful ideas (causality, forces, fields, etc.) that underlie each topic. We will want you to develop a clear understanding of these ideas. Though we will occasionally show you detailed mathematical analysis of specific situations, this will be to illustrate to you
the power of such methods, not to teach you to solve such problems yourself. That would be the conventional way to teach physics, and it is quite effective. Unfortunately, with that approach, it takes about three years to get to everything we want to study. Instead, we want you to learn how to apply those few powerful ideas directly to situations and to be able to describe qualitatively what will happen and why. This “deep qualitative” understanding is not easy, even for those who have mathematical skills well beyond what we require.

Students enter this course with a wide range of backgrounds and interests. For this reason, we really would like feedback from you. Let us know if the course is not meeting your expectations, if it isn’t clear what we expect from you, if there are things about your preparation that we are over- or underestimating, or if there are topics that you want to see discussed further, either because you didn’t quite get it, or because they were particularly interesting. The best way to deliver this feedback is to come to my (Peter Meyers’s) office hours or send me email. The next best is to discuss it with your preceptor.

The syllabus is built around some major revolutions in our physical understanding of the world. A mini-syllabus is:

— The description of motion
— Newtonian mechanics and the emergence of physical law
— The concept of energy and conservation laws as organizing principles
— Electric fields, light, and relativity
— Waves and quantum mechanics

Course structure

Lectures: Monday and Wednesday, 10:00-10:50 am, McDonnell A01. Demonstrations and explanations of the main topics for the week.

Homework/Precepts: Homework assignments will be posted on the web by Monday of each week. They will be due in the following precept. At the top it will give recommended reading for the week. The assignments will typically contain some numerical exercises and some situations to analyze using the concepts developed in lecture. The numerical exercises are not intended to be challenging—they are to help you to develop a feel for the magnitudes of the quantities we work with.

The precepts, all held on Friday, 10:00-10:50 am, will primarily serve as problem sessions, though your instructor may review other material, and, as always, you are welcome to ask questions. Working with other students and with help from your preceptor, you may finish your assignment in class! With this resource available to you come some responsibilities:

— To receive credit for a problem, there must be evidence on your paper that you at least attempted it before precept.
— Prior to precept, please work on your own (exception: office hours, see below.)
— The assignment is to be turned in class at your precept (attendance is required.)
— Late homework will not be accepted.
I may occasionally include a more challenging problem, with the understanding that it is likely to need discussion in precept. I will try to indicate that this is the case on the assignment. These are meant to be thought-provoking, not frustrating – think about them and bring your thoughts and ideas to precept.

**Laboratory:** You will have one lab a week in McDonnell 102, starting the second week of class. The general layout and specific procedures will be presented in a Lab Manual that will be distributed in sections through the term. We want you to be creative in the labs, and we intend to remove as many barriers to your thinking about (and enjoying) the labs as possible. Thus, lab writeups will be performed in the lab — there will be no long periods of writing up outside of lab. Also, the labs will be pass/fail, with the following system:

- You must successfully complete each lab, meaning that you must make a sincere effort and produce a satisfactory writeup.
- One failed or missed lab will result in the lowering of your final course grade by one letter grade; two will result in your **automatic failure** of Physics 111.
- There will be one lab week at the end of the term for making up up to two lab failures or **excused** lab absences.
- An excused absence means getting **prior** permission, for legitimate reasons (illness, out-of-town sporting event), from the course managers. Rather than waiting for the end-of-term makeup session, you are **strongly** encouraged to come to one of the other lab sessions in the same week if possible, again, through prior arrangement with Ms. Richick or Mr. Kicinski. Please make sure your preceptor knows when you do this so he/she knows count your lab.

**Office hours:** Our schedules will be posted on the web, and we will modify them as we determine what is most useful for you. You are also welcome to call up any of us to make an appointment to see us at times other than office hours. If you have questions about any aspect of the course, or about things that you wished were in the course, we would be delighted to see you. Nothing is out of bounds. For example, we would be happy to discuss and work on the week’s homework assignment with you. The goal of this course is for you to understand what we are talking about, not just to remember it.

**Textbooks and other materials**

The material we want you to learn will be covered in the lectures, homework assignments/precepts, and labs. Our approach doesn’t match any textbook, so **we do not require any textbooks**. However, there are two recommended books:

- March, *Physics for Poets*.
- Ostdiek and Bord, *Inquiry into Physics*.

Both are paperbacks; both are at the U-store.

I will typically give recommended reading assignments in both books each week. The two books will serve very different purposes. Our course syllabus roughly follows *Poets*. This book does a good job in organizing the ideas and in laying out the issues, but my impression is that the more detailed explaining it does is too brief to be fully understandable.
*IIP* is just a reference. You may find it useful to look at in connection with an individual problem on your homework.

I will place the following books on reserve in Fine Library (entrance across from the lecture hall). They are *optional* reading.

- Gonick and Huffman, *The Cartoon Guide to Physics*. Not as silly as it sounds – nice explanations of many of the things you will see in Physics 111.
- Lightman, *Great Ideas in Physics*. For a course very similar to ours.
- Feynman, *the Character of Physical Law*. For the Big Picture.

You will also need:

A lab notebook, bound with a cover and quadrille (graph) paper – Ampad WW-15 is a common choice.

A calculator. It must have trigonometric functions and square roots, but need not be fancier than that. Bring your calculator to **all** labs, precepts, and exams.

**Exams**

We will have a midterm during midterm week and a final. The exams will cover material from the lectures (including questions about specific demonstrations – attendance at lecture is **essential**) and the labs. Questions will be similar to those on the homework assignments. In order for you to get used to what we might ask, we will have a quiz after a few weeks.

**Grades**

The grading will go something like this:

- Written assignments/precept participation: 25%
- Quizzes: 10%
- Midterm: 30%
- Final: 35%

The labs are pass-fail, however, excellence in the lab will be used to decide borderline grading decisions.