Physics 117: General Course Information

Spring 2012

1 Prerequisites

Physics 117 is the second semester of introductory physics, and deals with the subjects of electromagnetism, optics, and electronics. We will assume that you are fluent with the material of Physics 116 or 123, mechanics, and that you are proficient with high school mathematics (algebra, trigonometry, geometry) and with calculus at the level of Math 111. If you have not had these prerequisites (or their equivalents), you should see me right away. If you are contemplating becoming a physics major, or if you are interested in seeing the same subjects but in a deeper and more mathematically-rigorous way, we encourage you to consider taking Physics 124 instead of Physics 117.

2 People

There are two faculty members associated with this course, Professors **David Hanneke** and **William Loinaz**. Prof. Hanneke will have primary responsibility for the laboratory portion of the course, and Prof. Loinaz will have primary responsibility for lectures, but you can talk to either of us about either part of the course. **Max Urmey** is the lab coordinator for the course; he'll assist with the running of the labs and the grading of the lab reports. Here's our contact information:

Instructor: Professor David A. Hanneke
Merrill 121
542-5525
dhanneke@amherst.edu
Office hours: M 10:50-11:45am, Tu 11:00-11:45am

Instructor: Professor William A. Loinaz
Merrill 223
542-7968
waloinaz@amherst.edu
Office hours: M 1:30–2:30 p.m., W from 1:30–3 p.m, and by appointment

Lab coordinator: Maxwell Urmey
Merrill 115
542-2062
murmey@amherst.edu
Office hours: F 2–4 p.m.

We'll also recruit someone to run a weekly evening help session. More on that as the semester progresses.

3 When and Where

The lecture part of the course will meet MWF 10:00–10:50 a.m in Merrill Science Center, lecture hall 2. The lab meets weekly for three hours in Merrill 208, either Monday 2–5 p.m. (section 1) or Tuesday 2–5 p.m. (section 2). Note that lab does not meet during the first and last weeks of classes, nor during a week of an exam.

4 Course Materials

- We'll use *University Physics* (13th ed), vol. 2 (Chap. 21-37) by Hugh D. Freedman and Roger A. Young. We'll also use the Mastering Physics online homework system. I've ordered a bundled version of the next textbook with Mastering Physics access through the Amherst Bookstore. The ISBN number for the text/Mastering Physics package is 9780321778253, in case you wish to order it elsewhere. For the text alone (without Mastering Physics) the ISBN is 9780321751218. If you wish to obtain Mastering Physics separately, you can buy it online using a credit card at www.masteringphysics.com. If you buy the text online, be careful to buy it for the 13th edition (I say be careful because they also sell it for the 12th edition of the text). If you're not sure whether you'll be taking the course, be a little cautious about buying the Mastering Physics access or breaking the seal on the password bundled with the book. I don't know how hard it is to get a refund if you change your mind about the course.

- We'll use PRS transmitters, hand-held radio student response devices, as part of the "class participation" component of this course.

- You'll be provided with a lab manual and notebook, which we'll charge to your student account.

5 Moving parts

- You should read at the **textbook** before we discuss a subject in lecture, then look at it again after.

- **Lectures** will be complementary to the text and will occasional cover the subjects differently or more deeply. We'll discuss the concepts, see how to work problems, and do demonstrations. To get the most out of lectures you should read the relevant part of the text beforehand. I'll encourage you to do this by assigning a Mastering Physics problem on the topic of the day, due before class. In class you'll use PRS transmitters to 'vote' on the answers to conceptual questions. When I use Powerpoint in my lectures, I'll post a version of them in advance on the course website. You'll be able to download and print them to and bring them to class to aid in your note-taking. Naturally, these will be no substitute for actually attending the class.

- **Labs**: Unlike in Physics 116, the labs and the lectures will cover different topics at different times. The labs will start with electronics, which the lecture part of the course will get into only after several weeks. This will make it especially important to read the manual before coming to lab. There will be three formal written lab reports during the semester, due at the start of the lab period following the experiment. For the other experiments, you'll do an exit interview upon completing the analysis. You'll also keep a lab notebook which will be periodically evaluated and included in your lab grade weighted equivalent to one lab report.

- **Problem sets**: I can't emphasize enough the importance of working the problems. In some of your classes homework is primarily evaluative; there, the point is for you to demonstrate what you've learned from the readings and lectures. In physics the homework is primarily instructional; you learn physics primarily by doing working problems. You must work the problems, think about the results, and understand any mistakes you've made if you wish to attain the type of understanding of the subject required of a working physicist. In at nutshell: If you can't work problems you don't know physics.

  There will be both written homework and homework assigned on the Mastering Physics online homework system. Both will count toward your course grade. Both are valuable: Mastering Physics gives you immediate feedback on your work, the written homework gives you practice setting up and explaining solutions and in particular drawing appropriate diagrams.

I won't accept late homework, since I want to post the solutions as soon as possible. If you have extenuating circumstances, have a Dean contact me to request and extension. In general, life will be easier if you do your best to finish the problem set on time and hand in as much as you've been able to complete by the deadline. The homework doesn't count for very much of the course grade, so if you occasionally don't finish the assignment it probably won't be a big problem.

- **Exams**: There will be two midterm exams and a final exam, and these will serve as the primary evaluative mechanisms for the course. The exams will be closed-book, and all course material (lectures, handouts, text readings and homeworks) are fair game for the exam. I'll give you relevant formulae, so the exams will be not be memorization exercises. I tend to like problems that ask that you derive results utilizing key derivations from class, then use the result to do something new.
- **Problem sessions**: We'll try to organize and evening problems session. I'll let you know more once we've recruited someone to run it.

6 Grading

- Problem sets: 15%
- Lab: 20%
- First Midterm: 20%
- Second Midterm: 20%
- Final: 25%

7 Statement of Intellectual Responsibility

I strongly encourage you to discuss the homework problems with your classmates—discussing and debating the concepts and procedures is a very effective way to learn. However, the final write-ups of your assignments should be your own. For example, the copying homework solutions in part or in whole from other students (current or prior) or from other sources (commercial or otherwise) is unacceptable. I don't mind if you use other texts to learn from, and if the answer to a homework problem is worked as a example in some other text you may utilize it (although you should first try to solve it on your own as best you can). But in that case you should make an explicit reference to the source in your homework, and of course you still need to explain the solution to the problem in your own words. It goes without saying, but

I'll say it anyway: tests are written without help.

In the lab you will perform the experiments in small groups, but formal lab reports are to be your own work, written individually.

If you have any questions about what is or is not acceptable under this policy, please ask us. In all cases, the spirit of the Statement of Intellectual responsibility will take precedence over legalistic convolutions of the text.

8 How to get the most from this class

- **Come to class** awake, on time, and prepared to participate.
- **Do the relevant reading**, work the pre-class Mastering Physics problems, and read through the problems assigned for the week **before the lecture** (I'll announce the readings and problems in class and post them on the website). Even if you don't understand the readings fully at the time, try to get the broad outline of the material so you'll have some hooks on which to hang the ideas that we talk about in class.
- **Note the role of the lecture and the textbook.** Lecture will not be a regurgitation of the text, a summary of all you need to know for the course, or a how-to guide for the homework. Rather, I'll try delve deeper into selected points. In lecture I'll cover material and do demonstrations related to the readings, but I won't feel obliged to be comprehensive in those places where I feel the text is adequate and I may focus only on a few points that I feel are particularly interesting or subtle. You shouldn't expect to understand what's going on without close study of the readings, and you should come to class with questions you have on the readings. Further, after we settle into the semester a bit, I expect the classes will become less lecture-oriented and more participatory; it will be difficult to reap the maximum benefit from that format if you're not sufficiently prepared to fully participate.
- **Work the problems: Start early. Try all of them. Struggle with them** awhile yourself—some will be clear, simple exercises meant to familiarize you with a procedure, others will be meant to stretch your understanding (some will be intentionally vague, so that you have to clarify the picture before solving the problem). Be sure you can state what ideas (mathematical and physical) are being utilized in each problem; even if you still can't solve the problem you're most of the way there. The ability to work problems is not sufficient to claim an understanding of the physics, but it is a necessary step.

  For the problems you can't solve, talk to classmates, attend the problem sessions, or ask me. When you ask me, I'll either try to give you just enough of a

hint to get you through, or I'll guide you through the problem with a series of leading questions. I'll never just tell you how to do it. If you run out of time and don't finish the set, start earlier next week. When the solutions come out, look over them right away, before you've forgotten all of the points you were confused about. You think you'll just get clear on it before the next exam, but there's never as much time as you think.

- **Ask questions**: in class, after class, during office hours, in problem sessions, in the hallways. Ask the questions you think you're supposed to know the answer to, the questions you're sure everyone else knows the answer to (they don't), questions about the overarching logic or the minute details, questions about the points or conclusions that weren't made that seem like they should follow. If individual arguments, their interconnection, or the entire point of the lecture don't seem clear to you, ASK. The main benefit to taking a class, especially at a small school like Amherst, is that you can ask questions of the experts.

- If things aren't going as you'd like, take an **active role** in improving your situation. Use all of the resources at your disposal. Step 1 is almost always to come talk to me. If you don't understand what's going on in lecture, the book, or the problems, if you feel like you can't keep up, come talk to me. I can help you, and I can point you to additional resources. Don't hide.

  On the other hand, if you find the class too slow for your liking, if you have questions that you aren't getting answers to, if you'd like more detail, if you are frustrated that we aren't digging deeply enough, if you crave more applications, come talk to me. I'm very happy to provide you with additional materials or explanations that will will stimulate you and challenge you at whatever level you can handle.

  One word of warning: Amherst College students tend to have lots of extracurriculars of all types. I support this and I am occasionally willing to be flexible to facilitate your participation in range of activities, but don't let your extracurriculars overshadow your academics. If you become concerned that your courses are getting in the way of your extracurriculars, you're thinking about it wrong way.

9 Tentative Syllabus

Week	Date	Topic	Chap.	Lab	Notes
1	Jan. 23	Electric Charge and Electric Field	21	No Lab	-
2	Jan. 30	Gauss's Law	22	1. Kirchoff's Rules	-
3	Feb. 6	Electric Potential	23	2. Ohm's Law (**formal**)	-
4	Feb. 13	Capacitance and Dielectrics	24	3. Introduction to the Oscilloscope	Report due
5	Feb. 20	Current, Resistance, and Electromotive Force	25	No Lab	Exam 1
6	Feb. 27	Direct-Current Circuits	26	4. Capacitors	-
7	Mar. 5	Magnetic Field and Magnetic Forces	27	5. Inductors	-
8	Mar. 12	Sources of Magnetic Fields	28	6. RLC circuits (**formal**)	-
-	Mar. 19	Spring Break	-	-	-
9	Mar. 26	Electromagnetic Induction	29	7. Faraday's Law and Induction	Report due
10	Apr. 2	Inductance	30	8. Properties of Light	-
11	Apr. 9	Alternating Current	31	No Lab	Exam 2
12	Apr. 16	Electromagnetic Waves	32	9. Geometric Optics (**formal**)	-
13	Apr. 23	The Nature and Propagation of Light / Geometrical Optics	33 & 34	10. Interference, Diffraction, and Polarization	Report due
14	Apr. 30	Interference / Diffraction	35 & 36	No Lab	-