Syllabus for Physics 211, spring 2009

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prerequisite The prerequisites are Math 150A and Physics 210, and the corequisite is Math 150B.

office hours My office hours are in the classroom (not my office), M 1:30-2:30, Tu 4:30-5:30, W 10:30-11:30, and Th 10:30-11:30, 1:30-2:30. I urge you to pick at least one of these office hours to come to every week as part of your habitual schedule; if none of my office hours fits your weekly schedule, please give me a copy of your schedule written out on a grid, and we'll see what we can work out.

web page `www.lightandmatter.com/area3phys206.html`
To e-mail me, use your Spotter account.

required materials The texts are *Relativity Simply Explained*, *Electricity and Magnetism*, *Optics*, *The Modern Revolution in Physics*, and the lab manual. You will also need a cheap calculator, two bound $10 \times 7\frac{3}{4}$-inch lab notebooks with graph paper pages (near the art supplies at the bookstore), a metric ruler, a protractor, a free FC computer account, and your own e-mail.

getting started Here's a quick summary of the things you need to do by the second class meeting:

1. Get everything listed under "required materials" above.
2. Print out the book and lab manual, or buy printed copies of them, using one of the options I described in my e-mail.
3. Read this syllabus.
4. Consult the schedule on page 4. Read the lab we're doing this week, and do the listed reading and the homework problems. Take notes on the reading, and make a photocopy of them.
5. If you don't already have e-mail, get an account.

grading Grades will be determined as follows:

homework	53 graded problems * @ 1 point each	53
reading quizzes	36 questions @ 1 point each	36
reading notes	18 @ 1 points each	18
check-off labs	12 @ 6 points each	72
lab writeups	4 @ 12 points each	48
prelabs	16 @ 2 points each	32
practice exams	2 @ 20 points each	40
midterm		360
final		360

* Calculus-based problems for Physics 211 students count as extra credit.

points	grade
80%	A
70%	B
60%	C
50%	D

portfolio and conferences I'll maintain a portfolio for you, containing your homework papers and your notes on the reading. I expect you to make an appointment with me for a 15-minute conference about once every four weeks, and in that conference we'll look at your portfolio together, and I'll try to give you guidance and help you to set specific goals, e.g., *master graphical addition of vectors*, or *solve problems symbolically rather than numerically.*

On any date when reading is assigned, you should be prepared for an open-notes quiz, and bring an extra copy of your notes on the reading; you'll turn in the copy, and I'll add it to your portfolio. It has to be a copy, because you need the original for your own use in studying. At conferences, I'll give you comments on your notes, and make suggestions for revisions. During tests, you are allowed to use the (revised) collection of notes from your portfolio. I suggest that you do

the notes on a computer (for ease of editing and copying), and that you do them after you read, not while reading (so that you know what ended up being the main points).

Usually during my regular office hours I'm splitting my attention among several students who are working on homework problems, and since the point of the conferences is to give you some individual attention, the times I'll offer for conferences will be outside of my normal office hours. If the times I offer aren't possible for you, please look at the schedule posted on the door of my office, and come up with a list of possibilities to show me.

OpenOffice for note-taking

The smartest way to do your notes is to write them on a computer and print out two copies. This way you can easily revise them later, and you don't have to hassle with photocopying. I recommend that you use the free OpenOffice word-processor, which you can download from openoffice.org. If you don't have a computer at home, you can use the ones in room 416 or 2000, which have OpenOffice installed. When you're writing equations, in most cases all you need in order to make them readable is a few superscripts. For example, suppose you want to write the equation $v^2 = 2ax$ in your notes. Just type `v2=2ax`, then select the 2 with the mouse and do Format>Character>Position>Superscript.

If you want to get fancier, you can use OpenOffice's built-in equation editor. Do Insert>Object>Formula, and an empty gray box for the equation is inserted in your document. An equation editor window pops up at the bottom of the screen, and a toolbox of mathematical symbols at the top. Although the toolbox is supposed to make it easier to find and enter the symbols you want, I found it to be more confusing; the most straightforward way to do it, in my opinion, is to type directly into the equation editor. You have to learn the codes for the things you want to type, but there are only three codes you'll typically ever need: `^` for superscripts, `_` for subscripts, and `over` for fractions. Enter a Greek letter as, e.g., `%theta` , making sure to put a space after it. As an example, to make

$$\Delta x = \frac{1}{2}at^2 + v_o t \qquad ,$$

you would do `%DELTA x = 1 over 2 at^2 + v_o t`. Note that the spaces after DELTA, both 2's, and o are mandatory. It understands parentheses, so, e.g., `1 over (2+3)` gives $\frac{1}{(2+3)}$. For invisible parentheses use curly brackets, e.g., `1 over {2+3}` produces $\frac{1}{2+3}$.

Spotter

Spotter is computer software I've written to help you check your answers to homework problems. It can check both numerical answers and symbolic ones. Having Spotter helps you more than having answers in the back of the book, because it is programmed to give you helpful pointers. If you put in an wrong answer that I've anticipated, it will explain why it's wrong. If your answer doesn't make sense in terms of units, it will tell you that. If you get a wrong answer, you can redo the problem and put in the right answer later for full credit.

Problems that are underlined on page 5 of the syllabus have purely mathematical answers, and are in Spotter. To get credit for an online homework problem, you need to enter a correct answer in Spotter, and also turn in your written calculations and explanations along with the rest of the homework. What I'm really trying to do here is get you to come to my office hours and get help if you can't get the right answer — Spotter helps you by letting you know whether you have the problem right *before* you turn it in.

You don't need to install the software; you just use it through a web browser. Start from the class's web page, then click on the link to the class's Spotter page. Once you're in Spotter, make sure to log in, or else you won't get credit for your work! Once you're logged in, all your answers will be recorded.

When using Spotter, you have to be careful about the notation you use for inputting mathematical expressions. Spotter is designed to allow you to use something resembling normal human mathematical notation, as opposed to the notation used in computer programs. However, human math notation is designed for humans, not computers, and you need to learn a few things about how to type your expressions in a form that Spotter will interpret correctly.

First, everything you type will be smashed down to one line of text, eliminating the superscripts and subscripts. For example, a variable name with a subscript, like x_1, is entered as `x1`. Since there are no superscripts, you have to enter exponents using the `^` symbol (shift-6), e.g., x^2 becomes `x^2`. You can enter a square root as either `sqrt(x)` or `x^.5`. There is no way to enter the times symbol, $\times$, without confusing the computer and making it think you meant the variable x, so in scientific notation you should simply leave a space where you would normally put the times symbol, e.g., 5×10^6 becomes `5 10^6`. Don't try to enter this as `5e+6`; that's what a lot of computer software would want, but Spotter is trying to interpret everything as normal human notation, so it will think you meant $5e + 6$, where e is a variable.

Another thing to keep in mind is that human languages, including human math notation, are ambiguous. Use parentheses liberally to make your meaning clear. There are two main situations where you need to watch out. First, arguments to functions: `sin 2x` will be interpreted as $(\sin 2)(x)$; if you intended $\sin(2x)$, you should have entered `sin(2x)`. Second, the bottom of fractions: `1/3c` will be interpreted as $(1/3)c$, so if you want $\frac{1}{3c}$, you need to enter `1/(3c)`.

academic honesty policy

If a student cheats on an exam, I will assign a zero on the exam, and I will also pursue action at the college level, which may result in penalties such as suspension or expulsion. I will also assign a zero in cases where two students turn in homework or lab reports that contain identical or nearly identical work.

labs

At the end of the first lab in the lab manual, there is information about the organization of labs. Note that most labs have prelab questions, which you're expected to turn in on a piece of paper (not in a lab notebook) at the beginning of lab.

If you miss a lab, you can only make it up in one of my other lab classes over the next few days, and it is still due at the same time it's due for everyone else. If you want to make up a lab, you should leave a note for Hanh Pham, the physics technician, in the physics stockroom in room 417T.

drops

I will drop you under any of the following conditions:

- You miss any lab or lecture during the first two weeks without contacting me in advance by e-mail.
- You miss an exam without contacting me in advance by e-mail.
- Over a period of seven consecutive days, you don't turn in any written work (homework and quizzes) on time and don't participate in lab.

Schedule for Physics 211, spring 2009

		read ch.	hw	topics	lab	
Jan. 13	Tu					
	Th	1*	1	Electricity and the atom.	23	static electricity
20	Tu	2	2	The nucleus.		
	Th	3	3	Circuits, part 1.	26	electrical resistance
27	Tu		4			
	Th		5		24	the oscilloscope
Feb. 3	Tu	4	6	Circuits, part 2.		
	Th		7		27	the loop and junction rules
10	Tu		8			
	Th	5	9	Fields of force.	28	electric fields
17	Tu		10			
	Th	6	11	Electromagnetism	29	magnetism
24	Tu			*practice exam 1*†		
	Th		12		38	electromagnetism
Mar. 3	Tu		13			
	Th	1**	14	The ray model of light.	33	e/m of the electron
10	Tu	2	15	Images by reflection, part I.		
	Th				*midterm*†	
17	Tu	3	16	Images by reflection, part II.		
	Th	4	17	Refraction and images.	40	refraction and images
24	Tu	G1***	18			
	Th	5,G2	19	Wave optics.	42	2-source interference
31	Tu	G3	20			
	Th	G4	21		41	geometric optics
Apr. 14	Tu	1****	22	Relativity		
	Th			*practice exam 2*†	43	wave optics
21	Tu		23			
	Th	2	24	Rules of randomness.	46	electron diffraction
28	Tu	3	25	Light as a particle.		
	Th	4	26	Matter as a wave.	45	photoelectric effect
May 5	Tu	5	27	The atom.		
	Th		28		47	hydrogen atom
12	Tu			*first half of final*†		
14	Th			*final exam*†		

†All exams are cumulative. Exams after the midterm will concentrate more on material that was not covered on the midterm. The last date to add notes to your portfolio for use on an exam is the preceding lecture.
Practice exam 1 covers all the reading through ch. 4 of *Electricity and Magnetism* plus all of Physics 205/210. The midterm covers *Electricity and Magnetism* and 205/210. Practice exam 2 covers *Electricity and Magnetism*, *Optics*, and 205/210. The final covers everything.
* Begin reading from *Electricity and Magnetism*. For the first reading assignment, in addition to the first chapter of *Electricity and Magnetism* you should download *Newtonian Physics* from `lightandmatter.com` and read chapter 1; you'll need this material in order to do problems involving scaling and order-of-magnitude estimates, such as homework problem #2 on the first homework assignment.

Homework

Homework assignments are listed on the following page.
Underlined problems are in Spotter (see page 2).
Note that in many of the homework problems, you need to look up data in the back of the book.

Homework Assignments for Physics 211

Homework assignments 1 through 14 are from *Electricity and Magnetism*:

hw 1: Ch. 1, #1 2,7
hw 2: Ch. 1, #5 3,4 Ch. 2, #1
hw 3: Ch. 1, #6 Ch. 2, #3,7 2,4,5
hw 4: Ch. 3, #6,7
hw 5: Ch. 3, #1,2,4
Do the conceptual exercises with circuits in Spotter, linked to from the class's web page.
hw 6: Ch. 3, #3,10,11 8
If you haven't done error analysis before in a lab class, read the relevant appendices in the lab manual to prepare for lab 27.
hw 7: Ch. 3, #5,9 Ch. 4, #1
hw 8: Ch. 4, #2 3,4
hw 9: Ch. 4, #5,6cd 6ab
hw 10: Ch. 4, #7-9 Ch. 5, #1
hw 11: Ch. 4, #10 Ch. 5, #5 2,3
hw 12: Ch. 5, #6 Ch. 6, #1bc,2b 1a,2a
hw 13: Ch. 5, #7 Ch. 6, #3,5 4
hw 14: Ch. 6, #6bcdfg,7 6ae

Homework assignments 15 through 22 are from *Optics* except as noted:

hw 15: Ch. 1, #1-4,6
hw 16: Ch. 1, #5 Ch. 2, #2,3 1
hw 17: Ch. 2, #4-7 Ch. 3, #1,2,7,8,10
hw 18: Ch. 3, #3,4,6 Ch. 4, #1,2
hw 19: Ch. 4, #4,7,15 10
hw 20: Ch. 4, #3,8 6,11 Ch. 5, #13
hw 21: Ch. 4, #12 Ch. 5, #2,10 12
hw 22: Ch. 5, #1,4,6,9,11 3 MR 1, #1

Homework assignments 23 through 28 are from *The Modern Revolution in Physics* except as noted:

hw 23: Ch. 1, #4 2,3,5
hw 24: Ch. 1, #6-8,10 Ch. 2, #1,2
hw 25: Ch. 2, #3-6,8 7 Ch. 3, #2
hw 26: Ch. 2, #9 Ch. 3, #5,8 1,11
hw 27: Ch. 3, #9 7 Ch. 4, #1-3,5
hw 28: Ch. 4, #4 Ch. 5, #1-3,5,6 4,7