

# Syllabus for Physics 223, spring 2008

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- prerequisites** The prerequisites are Physics 222 and Math 150B with grades of C or better.
- office hours** My office hours are in room 416P, which is the little room next to the classroom. My office hours are Tu 9-10, Tu 4:30-5:30, W 10:30-11:30, Th 9-10, and Th 4:30-5:30. 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/area3phys221.html](http://www.lightandmatter.com/area3phys221.html)  
To e-mail me, use your Spotter account.
- required materials** The texts are *Simple Nature*, *Optics*, *Relativity Simply Explained*, and the lab manual. Printed copies are available at the bookstore, and for all the books except *Relativity Simply Explained* you also have the option of downloading them from the class's web page.
- I also recommend that you get a another book to give you an alternative to my point of view. If you took 221 at Fullerton College, you already have part 2 of Halliday, which covers quite a bit of the material for this course. You may also want to buy part 5 of Halliday. If you have already taken Math 250, I recommend that as your second book you buy volume 1 of *The Feynman Lectures on Physics* by Richard Feynman, ISBN 0201510030, which is about \$36 new or \$15 used online.
- You will also need a cheap calculator, two bound lab notebooks (either  $10 \times 7\frac{3}{4}$ -inch or  $9\frac{3}{4} \times 7\frac{1}{2}$ -inch) with graph paper pages (near the calculators in the bookstore), 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 6. 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.
6. Do the prelab for the first lab.

**grading** Grades will be determined as follows:

homework	115 problems @ 1 point each	115
reading quizzes	48 questions @ 1 points each	48
reading notes	24 @ 1 points each	24
check-off labs	10 labs @ 6 points each	60
lab writeups	4 @ 12 points each	48
prelabs	14 @ 2 point each	28
exams	4 exams @ 180 points each	720

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

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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.

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.

participation grade

I'll give you a participation score in the course, and if it gets too low, I'll drop you. Since written work is due at every class meeting, my method for recording participation is to check whether you turn in the written work on time. Participation credit for each week is on an all-or-nothing basis: to get credit, you have to do all the things that are required for that week.

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.
- During the first or second week, you go a whole calendar week without turning in any written work in a form that is acceptable for participation credit.
- Your participation grade is below 50% after the end of the first two weeks.
- Your participation grade falls below 66% at any time after the end of the third week.
- You miss two lectures and a lab within seven consecutive days.

*Standards for written work to count for participation*

*Quizzes:* Turn in the quiz on time.

*Homework:* To get participation credit, you must either get at least 1 point on your assignment, or else attempt every problem. It only counts as attempting the problem if what you write (1) shows that you read the question and also (2) records some steps toward the solution, or explains what you didn't understand or how you got stuck.

*Lab reports:* You must show up, participate actively, and get complete data (or stay until the end of the period), and if you have a lab report due from the week before, you must turn in a lab report that either (a) gets a score of at least 1 point, or (b) has complete data, and is written in the format described in the lab manual. (Each lab can affect your participation grade negatively for a maximum of one week.)

*missing a class*

If you know you're going to miss a class, you can preserve your participation grade by doing the following things:

- Turn in the homework in advance, either via a plain text email, or on paper in my mailbox at the division office.
- Turn in your reading notes in advance, either by e-mail or on paper.

- If necessary, make arrangements to make up the 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 her mailbox at the natural science division.
- If necessary, turn in your lab writeup, either on paper or by e-mail. If you're e-mailing it, it can be either plain text or an attachment that I can open in OpenOffice; to send me an e-mail with an attachment, you'll have to go to [lightandmatter.com](http://lightandmatter.com) and follow the "contact" link.

**e-mail** Don't be shy! You can e-mail me any time. Just log in to Spotter and click on **e-mail**. However, e-mail is usually a lousy way to get help on homework, unless your question is very simple and specific.

**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.

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.,  $5 \times 10^6$  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)`.

rules rules rules

*exams*

Exams will include all topics covered in the reading, not just the ones discussed in lecture. The format of the exam questions will be like that of the homework problems, requiring a mixture of mathematical reasoning and short answers to conceptual questions. The main difference is that exam questions will never be very long or complicated.

Exams are to be done completely independently and without communicating with other students. Calculators and dictionaries are allowed. In-class exams are open notes and closed book. Open notes means only the notes from your portfolio.

You may not write direct quotes from the text or another source. If such a quote is unattributed, it constitutes plagiarism. Even if it is attributed, it violates the

rules for exams, since the notes you bring to the exam must be your own original work.

If you leave an exam for any reason other than a serious health problem, you may not come back and work on the exam any more. It is up to you to go to the bathroom before starting the exam. In the event of a serious health problem, you must tell me why you are leaving, go directly to the student health center, and bring back a note from the health center verifying the health problem.

#### *homework*

(1) All homework is due at the beginning of class. If there is a reading quiz, I will accept late homework up until the end of the reading quiz, i.e., 5 minutes after class begins; in this situation, drop it on the pile on your way to your seat. Except for this situation, I do not accept late homework.

(2) You must show your work. Answers with no explanation will receive no credit.

(3) Any number measuring something physical has units, and is meaningless without them. It does not make sense to say someone is “5 tall” — she is 5 *feet* tall. Your numerical answers must have units, unless they simply count the number of something.

(4) Your final answer must have the correct number of significant figures.

(5) Online homework: Problems that are underlined on page 7 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.

#### *lab reports*

(1) Prelabs are due at the beginning of the lab period.

(2) 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 her mailbox at the natural science division.

(3) You should try to finish your analysis and writeup in lab, where I’m available to help. People who do the writeup in lab, and check with me for guidance while doing it, usually end up getting 100% of the points, as well as the satisfaction and educational benefits that come with doing a perfect job.

Even if you don’t have time to finish your writeup in lab, I require you either to do the postlab check (and get it right!) or else stay the full three hours; I will not accept your writeup otherwise. This is to ensure that you don’t leave with bad data, and that you know how to do the analysis.

If you don’t have time to finish your writeup during lab, then you can turn it in up until the beginning of the lab period a week later.<sup>1</sup>

(4) In many cases, I will allow you to do a verbal check-off of your results for full credit, rather than having to turn in a lab writeup.

- A check-off is not a right, it’s a privilege. A check-off is worth 100%, which is an A+, so to get it, you need to do A+ work.
- You should write down an abstract as part of your check-off. This shows me you understand the point of the lab, and didn’t just go through the motions robotically.
- Check-offs aren’t my highest priority if some groups are still struggling to get data, and need my help.
- There is a limited number of computers in the lab. If you think a computer will help you to get your analysis done quickly enough to do a check-off,

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<sup>1</sup>If there is no lab meeting a week later, the writeup is due in lecture that day, or at the next meeting if it’s a holiday.

you may want to go to one of the other computer labs rather than waiting for a chance to use one of the ones in the lab room.

- You are required to turn in formal lab writeups for at least three labs over the course of the semester, and those are worth more points.

**academic honesty  
policy**

I will give an automatic F in the class to any student who cheats or breaks the rules on a quiz or exam, plagiarizes, falsifies data, makes use of another student's work without that student's permission, turns in homework answers that originated from my solution handouts, or is intellectually dishonest in any other way that is serious, premeditated, or ongoing. The college may also take action.

In less serious cases of academic dishonesty, or in cases of cooperation that falls outside the guidelines given on page 5, I will assign a zero on the assignment. This includes cases of two students submitting homework assignments or lab reports that contain identical or nearly identical work.

**cooperation**

Cooperation is good, as long as you do it right. I have some specific rules on cooperation, spelled out below. In general, problems come up when there is an unequal relationship between a student who is doing well and one who is doing poorly. If you're struggling with the class, it may seem like a good deal if you can get what amounts to free tutoring from another student. However, tutoring is difficult to do well, and can easily degenerate into mindless copying. If you want free tutoring, come to my office hours!

Only very limited cooperation on homework and lab reports is allowed. You may help each other when one of you is stuck by giving general pointers. You may not turn in work that is identical, paraphrased, or extremely similar, either in whole or in part. In such cases, I will give zeroes to everyone who turned in overly similar work, regardless of who copied from whom. Students often assume naively that in science, there is only one correct procedure for solving a problem, and only one right answer; actually every person will approach the same problem differently, and it's usually painfully obvious to me when someone didn't do his/her own work. If student A understands how to do the problem and B doesn't, a good rule of thumb is that when A helps B, only B's paper should be on the table, and only B should hold the pen. Talking on the phone is excellent.

All of this applies to the FC tutoring center as well. The tutors don't know my standards for cooperation, and aren't responsible for knowing them. For example, if a tutor starts writing equations for you, you need to explain that that type of help isn't allowed in my class — the pen needs to be in your own hand, not the tutor's.

## Schedule for Physics 223

		read ch.*	hw	topics	lab
Jan.15	Tu			Thermodynamics.	
	Th	5.1-2	1		16 absolute zero
22	Tu	5.3-4,G1	2		
	Th	6.1,G2	3	Free waves.	17 Clement-Desormes
29	Tu		4		
	Th	6.2,G3	5	Bounded waves.	21 standing waves
Feb. 5	Tu	8.2**	6		
	Th		7		22 resonances of sound
12	Tu	7.1,11.1,G4-5	8	Basic relativity.	
	Th		9		32 relativity
19	Tu	7.2,G6-7	10	The Lorentz transformation.	
	Th		11		48 Michelson interferometer
26	Tu	7.3	12	Dynamics.	
	Th				<i>Exam 1</i> †
Mar. 4	Tu	Op1	13	The ray model of light.	
	Th	Op2	14	Images by reflection, part 1.	42 two-source interference
11	Tu		15		
	Th	Op3	16	Images by reflection, part 2.	44 polarization
25	Tu	Op4	17	Refraction and images.	
	Th		18		40 refraction and images
Apr. 1	Tu			<i>Exam 2</i> †	
	Th	Op5	19	Wave optics.	41 geometric optics
8	Tu		20		
	Th		21		43 wave optics
15	Tu	12.1,8.2***	22	Nuclear physics.	
	Th		23	Rules of randomness.	46 electron diffraction
22	Tu	12.2	24	Light as a particle.	
	Th			<i>Exam 3</i> †	45 photoelectric effect
29	Tu	12.3	25	Matter as a wave.	
	Th		26		47 hydrogen atom
May 6	Tu	12.4	27	The atom.	
	Th		28		no lab
13	Tu		29		
15	Th			<i>Exam 4</i> †, 5:30-7	

\* Reading is from *Simple Nature* unless otherwise noted. Op stands for Optics, and G for Gardner's *Relativity Simply Explained*.

\*\* If you didn't take physics 222 from me, skim section 8.2 for some background material that I assume you know. The main point is to get the general ideas, and to know that this information is there, so that you can look up details later if you need to.

\*\*\* If you didn't take physics 222 from me, reread section 8.2 more thoroughly, and take more detailed notes.

†All the exams are cumulative, but concentrate on the most recent topics. The final is just like any other exam. The last date to add notes to your portfolio for use on an exam is the preceding lecture. Exam 1 covers physics 221-222, and all reading through section 7.2 of *Simple Nature*. Exam 2 covers physics 221-222, and all reading through ch. 3 of Optics. Exam 3 covers physics 221-222, and all reading through section 12.1 of *Simple Nature*. Exam 4 covers everything.

## Homework Assignments for Physics 223

Please turn in homework in the following format:

- Staple the pages together. I will not accept unstapled homework.
- Write your name at the top of the front of the first page and the back of the last page.
- Leave the top 25% of the front page blank so I can write your grades there.

If your paper isn't formatted this way, I'll take off two points.

Underlined problems are in Spotter (see pages 3 and 4).

"Challenge" problems are more difficult problems that can be done for extra credit. If you do a challenge problem, write me an eye-catching note on the front of your homework so I'll know to grade it.

Note that in many of the homework problems you need to look up data in the back of the book.

Some homework problems have solutions in the back of the book. You should do them, and check yourself, but you don't need to turn them in for credit.

Homework assignments 1-13 are from *Simple Nature*:

- hw 1: Ch. 5, #1  
Depending on your previous scientific knowledge, you may find it helpful to skim section 8.2 before doing the homework, since some of the problems assume you know what a proton is, what atomic number is, etc.
- hw 2: Ch. 5, #2,8 3,5
- hw 3: Ch. 5, #4,6,7      Ch. 6, #7
- hw 4: Ch. 6, #1,2 10
- hw 5: Ch. 6, #3,5,9 4,6,8
- hw 6: Ch. 6, #11,13 12
- hw 7: Ch. 6, #14,15,17
- hw 8: Ch. 6, #16 Ch. 7, #21  
If you took 222 from me, then you've already done problem 21; just write a note to that effect on your paper.
- hw 9: Ch. 7, #1 2  
If you took 222 from me, then you've already done both these problems. You don't need to turn in this homework.
- hw 10: Ch. 7, #16,17
- hw 11: Ch. 7, #3,4
- hw 12: Ch. 7, #5,6
- hw 13: Ch. 7, #7-12

Homework assignments 14-21 are from *Optics*, except for problems labeled SN:

- hw 14: Ch. 1, #1-5 SN 7, #15 19,20  
For Optics #3, you'll need to refer to your 222 book.
- hw 15: Ch. 2, #2,3 1
- hw 16: Ch. 2, #5-7
- hw 17: Ch. 2, #4 Ch. 3, #1,2,7,8,10
- hw 18: Ch. 3, #3,4,6 challenge: 5 Ch. 4, #1,2
- hw 19: Ch. 4, #3,4,7 10 challenge: 5
- hw 20: Ch. 4, #8 6,11 challenge: 9 Ch. 5, #13
- hw 21: Ch. 4, #12      Ch. 5, #2,10 12

Homework assignments 22-29 are from *Simple nature*, except for problems labeled Op:

- hw 22: Ch. 12, #1-3 Op 5, #1,9
- hw 23: Ch. 12, #4,5,9,10 6
- hw 24: Ch. 12, #7,8,11
- hw 25: Ch. 12, #12-14,35,36
- hw 26: Ch. 12, #15,16,19,20
- hw 27: Ch. 12, #25 21-23
- hw 28: Ch. 12, #26,29,30 28
- hw 29: Ch. 12, #27,32,33 31