

Syllabus for Physics 223, spring 2019

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- prerequisites** The prerequisite is Physics 222 with a grade of C or better.
- office hours** The following office hours are in room 415-P (not my office): Tu 8:30-9:30, 4-5:30, Th 8:30-9:30, 3:30-5:30. I urge you to pick at least one of these office hours to come to every week as part of your habitual schedule. When you show up to my office hours for help with homework, I expect you to bring both the book and your own copy of your reading notes (see below).
- web page** www.lightandmatter.com/area3phys221.html
To e-mail me, use your Spotter account.
- required materials** The texts are *Simple Nature* and *Relativity Simply Explained*. You'll also need a 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 (across from the colored pens at the bookstore) a metric ruler, and a protractor. You can use a dictionary on exams, but it has to be a printed dictionary, not an electronic one.
- getting started** Here are the things you need to do by the second class meeting:

1. Get everything listed under "required materials" above. You can buy the book at the FC bookstore or download it. Download and print the lab manual. The downloads are linked to from the class's web page.
2. Read this syllabus.
3. Use the link at the class's web page to get a printout of your homework assignments.
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 print two copies of them.
5. If you don't already have e-mail, get an account.

grading Grades will be determined as follows:

homework	118 problems @ 1 point each	118
reading quizzes	45 questions @ 2 point each	90
reading notes	24 @ 1 points each	24
check-off labs	7 @ 10 points each	70
lab writeups	5 @ 20 points each	100
prelabs	14 @ 2 points each	28
exams	4 @ 150 points each	600

points	grade
80%	A
69%	B
58%	C
47%	D

reading notes I'll maintain a folder for you containing your notes on the reading. These are the notes you get to use on the exams. You should do the notes on a computer (for ease of revision), and do them after you read, not while reading (so that you know what ended up being the main points). I will not accept hand-written notes.

On any date when reading is assigned, you should be prepared for an open-notes quiz, and print out an extra copy of your notes on the reading; you'll turn in the copy, and I'll add it to your folder. It has to be a copy, because you need the original for your own use in studying and problem solving. I expect you to bring your own copy of your notes to school so that, e.g., we can refer to them together if you're getting help in my office hours.

Your notes need to be entirely in your own words; stating everything in your own words is a good way to test and consolidate your own understanding. Cutting and pasting from the book would be a form of cheating on exams (because the

exams are not open-book), and would also be plagiarism if the copied material wasn't properly attributed.

Shorter is better. The laws of physics are fundamentally simple. I would suggest limiting yourself to no more than quarter of a page per chapter. By the end of the semester, the simple underlying structure of the material will have become more and more obvious to you, and I think you should be able to go back over your notes and edit them down to no more than about a page *total*. It's not against the rules for your notes to be too long, but it's not smart, either; long notes usually indicate that you're not distinguishing fundamental principles from trivia, or that you're making futile efforts to write a cookbook of problem-solving techniques, which is a self-defeating way to approach problem solving. If it feels too scary to walk into an exam with short notes, I suggest making a separate long version as a security blanket, but sealing them shut with a big binder clip to remind yourself that using them is probably a mistake, indicating that you aren't working from basic principles.

Google Docs for note-taking

For note-taking, I recommend that you use Google Docs, docs.google.com, which makes it easy to do equations. It works in any web browser, and you don't have to install any software. To do an equation, go to the Insert menu and choose Equation. You can then type in your math. A toolbar also comes up, just above the top of the page, with symbols in it like square roots. I found the toolbar confusing when it came to doing exponents; the easiest way to do it is to enter, e.g., x^2 for x squared. Printing works, but is a little awkward and ugly. A PDF file pops up, with your equations rendered at low resolution. You then have to print the PDF file (i.e., you have to do two print commands in order to get the output to actually go to the printer).

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 the homework page 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 "homework" 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 \wedge symbol (shift-6), e.g., x^2 becomes x^2 . You can enter a square root as either $\text{sqrt}(x)$ 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.

Human languages, including human math notation, are ambiguous. Use paren-

theses 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)`.

As you type your answer, the computer will display a rendering of it into “real” human math notation so that you can see how your input is being interpreted. If you’re using this feature in a browser such as Internet Explorer that has poor math support, it will be slow, especially the first time you use it on a particular computer.

**academic honesty
policy**

In cases of serious academic dishonesty, I will assign a zero on the work, and I will also pursue action at the college level, which may result in penalties such as suspension or expulsion.

hw

labs

At the end of the first lab in the lab manual, there is information about the organization of labs. 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 rest of the week, and it is still due at the same time it’s due for everyone else. If you want to make up a lab, email me, and I’ll coordinate with the physics technician.

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.
- If I don’t receive a homework paper from you, I will consider that the same as an absence on that day, which during the first two weeks would cause me to drop you. If you’re late to class, put your paper on the podium without interrupting class. Even for an assignment that happens to have only online homework, you are still required to turn in the paper showing your work on the online homework. You don’t need to get any problems right in order to fulfill this requirement, but you do need to show some attempt at a solution for at least some problems on each assignment. It’s not enough to write “I don’t know how to do this problem,” but it is enough if you write, “I tried to do this problem using the equation $v^2 = 2ax$, but that didn’t work because I couldn’t figure out how to get x .”
- 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 homework papers or quizzes, and don’t complete all the lab work (participating in lab, and turning in written lab work when it’s due).

Schedule for Physics 223, spring 2019

		read ch.	hw	topics	lab††
Jan. 29	Tu			Pressure and temperature.	
	Th	5.1-2*	1*	Ideal gases.	1 absolute zero
Feb. 5	Tu	5.3-4	2	Entropy.	
	Th	6.1§	3	Finish thermodynamics. Waves.	2 two-source interference
	Tu	6.2	4	Bounded waves.	
	Th	12.1-2	5	(Waves, cont'd.) Images by reflection.	3 standing waves
	Tu	G1**,12.3	6	Images, quantitatively.	
	Th	G2,12.4	7	Refraction.	<i>Exam 1</i> †
	Tu		8		
	Th	G3,12.5	9	Wave optics.	5A and 6A, refraction
Mar. 5	Tu	G4	10		
	Th	G5,7.1-7.2.5	11	Relativity.	7 wave optics
	Tu	3.1.6,7.3.1-2	12	Dynamics.	
	Th	11.1.1	13	Electromagnetism.	10 relativity
	Tu		14		
	Th	11.5.2,11.6***		Electromagnetic waves.	<i>Exam 2</i> †
	Tu	8.2	15	The nucleus.	
	Th	13.1	16	Probability.	11 polarization
Apr. 2	Tu		17	Problem solving.	
	Th	13.2	18	Light as a particle.	12 radioactivity
	Tu	10.5.5-7	19	Complex numbers.	
	Th		20		9 electron diffraction
	Tu	13.3.1-5	21	Matter as a wave. Plan lab 13.	
	Th	13.3.6	22	Schrodinger equation.	13 photoelectric effect
	Tu		23		
	Th	13.4.1-5		The hydrogen atom.	<i>Exam 3</i> †
May 7	Tu	13.4.6-7,14.1	24	Spin. Multi-electron atoms.	
	Th	14.2	25	Rotation and vibration.	14b (or c if you're interested)
	Tu	14.4	26	Time-dependent Schrodinger eqn.	
	Th	14.6	27	Structure of quantum mechanics.	...flexible time for lab 14...
	Tu	14.10	28	Quantum computing.	
	Th		29	<i>Exam 4</i> †	

§Also watch the video on consonance and dissonance linked to from the book's web page, which is a preview of some material from sec. 6.2.

†Bring a bluebook. All exams are cumulative. Each exam will concentrate on the material that you haven't yet been tested on. *notes_{deadline}*

Exam 1 covers physics 221 and 222, plus all material in this course through sec. 6.1. Exam 2 is through ch. 12. Exam 3 is through ch. 10. Exam 4 covers everything.

* Whenever reading is assigned, you should bring both copies of your notes to class. To find out what homework problems you've been assigned, go to the class's web page and click on the link that says "homework printout."

** G1, G2, etc., refer to chapters from Gardner.

*** The notation Φ_E refers to the electric flux $\oint \mathbf{E} \cdot d\mathbf{A}$, and similarly for Φ_B . The notation Γ_E and the term "electric circulation" refer to $\oint \mathbf{E} \cdot d\mathbf{s}$, and similarly for the magnetic quantity.

**student learning
outcomes**

I. Outcome: Upon successful completion of PHYS 223 F General Physics III, the student will be able to determine qualitative outcomes of various physics scenarios by applying deductive reasoning with the appropriate laws and principles of physics. Assessment: Common questions or problems embedded in a final. Project assessed against a department standard. Students demonstrate their ability to determine qualitative outcomes of various physics scenarios in regularly scheduled conceptual homework assignments, group projects in class, and conceptual examinations for each major topic throughout the course and in a cumulative final examination at the end of the semester.

II. Outcome: Upon successful completion of PHYS 223 F General Physics III, the student will be able to determine quantitative outcomes of various physics scenarios by applying algebra, trigonometry, geometry, and calculus with the appropriate laws and principles of physics. Assessment: Common questions or problems embedded in a final. Students demonstrate their ability to determine quantitative outcomes of various physics scenarios in regularly scheduled analytic homework

III. Outcome: Upon successful completion of PHYS 223 F General Physics III, the student will be able to investigate various physics scenarios experimentally and explain the results in terms of the appropriate laws and principles of physics. Assessment: Project assessed against a department standard. Students demonstrate their ability to investigate various physics scenarios experimentally by doing so in the laboratory under instructor supervision in regularly scheduled laboratory sessions throughout the course. They demonstrate their ability to explain the results in a written report for each laboratory session.

**students with
disabilities**

Fullerton College is committed to providing educational accommodations for students with disabilities upon the timely request by the student to the instructor. Verification of the disability must also be provided. The Disability Support Services office functions as a resource for students and faculty in the determination and provision of educational accommodations. (Faculty Resource Guide at <http://staffdev.fullcoll.edu/>)