Physics Department, California State Polytechnic University, Pomona

Physics 234

Winter 1999

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Course Description: Physics 234 extends the three-quarter, calculus-based introductory sequence, Physics 131-133. We complete the study of electricity and magnetism begun in Physics 133 ending with the phenomenon of electromagnetic waves. This leads naturally into the study of optics and, finally, the theory of special relativity.

Conditions of enrollment: Physics 132 and 133 (General Physics) are prerequisites for all students enrolled in this course. Physics 234L (General Physics Lab) is a corequisite for physics majors.

Texts: *Physics for Scientists and Engineers*, 4th Ed., by Serway
Spacetime Physics, 2nd Ed., by Taylor and Wheeler

How to get help: My formal office hours are Wednesdays 1-2 and Fridays 3-4. If you can't come during these hours, I'll be happy to make an appointment for another time. For me, one of *the* most enjoyable aspects of teaching is working with students one-on-one and clearing up specific problems. *Please* come see me often.

Problem Sets: I will assign 15 to 25 problems from each chapter. These will be your best indication of the material that I want to emphasize and the level of understanding that I expect you to attain. Furthermore, working out solutions to these problems is probably about the bare minimum of practice on your part that is likely to yield that level of understanding. I will ask you to turn in some of these in problem sets that will be due approximately once a week.

As you probably know by now, the purpose of assigned problems in physics is absolutely *not* to see if you can get the right answer. Rather, it is for you to practice and then demonstrate that you have learned 1) how to determine the fundamental physical principles that are involved in each situation and 2) how to apply those principles in a disciplined and orderly fashion.

Accordingly, I am not interested in problem "solutions" that simply consist of a series of mathematical manipulations leading to a numerical answer. Instead, the problem solutions that you submit are to be "presented." By this I mean that they should be readable by someone who does not have access to the problem statement, should include written explanations and thoughtful comments, should use well-defined and consistent notation, should be accompanied by neatly drawn and carefully labeled diagrams, and should flow in a logical and orderly progression down the page. There should be relatively few equations and *certainly* no long strings of algebraic manipulations. When there is a lot of algebra to be done do it (carefully!) on scratch paper. In your *presentation* say, *e.g.*, "eliminating p and m from equations 4, 6, and 9 and solving for E gives us ..." and then simply *give* the result.

I will look over your work and assign a holistic score of 1 to 4 with 4 meaning that the problem set is *exceptional*—complete, *very* well presented, and mostly correct; 3, good – at least nearly complete, clearly presented, and pretty much correct; 2 – incomplete or not very clearly presented; 1 – not a good faith effort. (Please see the sheet I will hand out with examples of solutions that merit the various scores.) Unsubmitted (or as good as unsubmitted) problem sets will receive a 0. I do not accept late problem sets, but, in order to allow for extraordinary circumstances (*including* absence for *any* reason), I will throw out your two lowest problem set scores.

I *strongly* encourage you to form study groups and to discuss with others your readings, questions that come up in and out of class, and how to go about solving problems. The work *you* turn in, however, must be *yours*, based on the understanding *you* have acquired. When faced with two write-ups that show any signs of copying, I conclude that at least one person hasn't done the work. In such cases *both* papers *will* receive no credit.

Quizzes: There will often be brief (~2-4 minute), unannounced, closed-book quizzes usually given at the very *beginning* of the class period. Quizzes will test only for a basic understanding of recent material and for the most minimal level of comprehension of the day's assigned pre-class study. They will be scored on the same 4 point scale as the problem sets with the following meanings: 4 – no significant errors, you are clearly on top of things, 3 – minor errors, but basically O.K., 2 – substantive errors, this material needs immediate attention, 1 – no evident preparation or practice on material, pretty serious trouble. Missed quizzes will receive a 0. In order to allow for extraordinary circumstances (*including* absence for *any* reason), I will throw out your two lowest quiz scores.

Daily assignment: At the beginning of each class you will turn in a sheet with the following:

1 Your name
2 The reading assignment (e.g., "Serway 2.1-3")
3 An estimate of the amount of time you spent studying the reading assignment
4 Completions of several of the following thoughts (or make up one of your own)
   - A "One thing I don't understand is ...
   - B "One of the most important points in these sections is ...
   - C "The paragraph that really lost me was ...
   - D "I think the following must be a mistake: ...
   - E "Instead of ..., why doesn't the text simply say ... ?
   - F "The following seems to me like a counterexample to what the book says about ...
   - G "The most surprising/interesting thing I learned was ...

I will mark each submitted sheet with either a check (signifying a good faith effort) or an X (signifying the opposite.) A single score for these assignments will be derived as 4 times the fraction that you receive of the maximum possible number of checks.

Course Involvement and Subjective Evaluation: Class time will be conducted in a participatory fashion. A small portion of your grade, assigned on the same 4 point scale, will be determined by my own subjective impression of your involvement in the class as evidenced through attendance, preparation, class participation, and office visits. Most of you will likely receive a 3 (meaning O.K. to good) with other scores reserved for clearly "distinguished" levels of involvement.

Examinations: There will be an in-class midterm, a take-home practice exam, and a final exam. The midterm will count for 1/3 of your overall exam score and the final for the other 2/3. If you wish, you may take the practice-exam for credit in a two hour evening session on Wednesday, February 24. In that case—and only *if* it helps your overall grade—the midterm and the practice exam will count equally for 1/2 of your exam grade and the final for the other half.

Grading: I do *not* grade on the curve so there is a tremendous advantage to be gained from working productively with your classmates.

I will combine your problem set, quiz, daily assignment, and subjective scores with relative weights of 4, 3, 2, and 1 respectively into a single "effort" score on the same 4 point scale . Grades will then be assigned using the following grid:

		----------Exam Score----------				
		Excellent 80% - 90%	Good 66% - 80%	Satisfactory 52% - 66%	Substandard 40% - 52%	Unsatisfactory 25% - 40%
Effort Score	4	A	A-	B+	B-	C
	3	A	A-	B	C+	C-
	2	A-	B+	B-	C	D
	1	B+	B	C+	D+	F
	0	B+	B-	C	D	F

(All grades reflect the midrange and are ± roughly one step)

AJM:1/4/99

Academic Integrity: Please be aware of the statement on academic integrity in the University catalog. My strongest desire is to act as facilitator for your studies in physics. Accordingly, I operate on the assumption that all of our interactions are based on honesty and good faith. I have no desire to act as policeman, just as *you* should not have to be concerned about being treated fairly and with respect. Because our trust in each other is crucial to the effectiveness of our relationship, I take an uncompromising stance on the necessity for sanctions when it is violated.

Course Schedule:

Date	*Before class*	*Topics/Events*
1/4	—	Course organization; introductory remarks
1/6	Serway 33.1-5	Inductors, resistors, and capacitors in alternating current circuits
1/8	Serway 33.6-8	Power and resonance in alternating current circuits
1/11	Serway 33.9	Transformers and AC power transmission
	34.1-2	Electromagnetic waves
1/13	Serway 34.3-4	Intensity (energy transport) and pressure (momentum transport) in EM radiation
	34.6-7	Antennae; the EM spectrum
1/15	Serway 35.1-4	The nature of light; the ray approximation; reflection and refraction
1/18	***(Holiday)***	
1/20	Serway 35.5-8	Dispersion; Huygens' Principle; total internal reflection; Fermat's Principle
1/22	Serway 36.1-2	Geometrical optics: Images formed by reflection
1/25	Serway 36.3-5	Geometrical optics: Images formed by refraction
1/27	Serway 36.6-10	Optical instruments
1/29	Serway 37.1-3	Wave optics: Interference from coherent sources; the double slit
2/1	Review	**In-class midterm** (Chapters 33 through 36.5)
2/3	Serway 37.4-7	Phasor methods; thin films; the Michelson interferometer
2/5	Serway 38.1-2	Wave optics: Diffraction
2/8	Serway 38.3-5	Resolution and the diffraction grating
2/10	Serway 38.6	Polarization
	Serway 39.1-2	The principle of relativity and the speed of light
2/12	***(Holiday)***	
2/15	Serway 39.3-4	Consequences of the principle of relativity
2/17	T&W 1.1-5	"Events" and the "spacetime interval"
2/19	T&W 2.1-10	Inertial ("local free-float") frames in relativity
2/22	T&W 3.1-9	Relativistic effects, derivation of the "spacetime interval"
2/24	T&W 4.1-10	Relativistic space travel and the twin paradox
		(evening) **Optional second exam** (see "Examinations")
2/26	T&W 5.1-6	Spacetime diagrams and the "worldline"
3/1	T&W 5.7-10	More about worldlines
3/3	T&W 6.1-3	The "light cone", the past, the future, and elsewhen
3/5	T&W 7.1-3	Momenergy
3/8	T&W 7.4-7	Conservation of momenergy
3/10	T&W 8.1-5	Relativistic particle physics
3/12	T&W 8.6-8	High energy particle collisions, fission, fusion, annihilation
3/15 (Monday)		**Final Exam** (1:40-3:40)

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