Syllabus for PHYS 3700: Modern Physics

University of Georgia, Spring ~~2018~~
MWF Period 4 (11:15-12:05 PM), Room ~~327~~

Basic Information

Instructor: Professor Steven P. Lewis
307A Physics Building
Phone: 706-542-0158
Email: *lewis@physast.uga.edu*

Office hours: To be determined once student schedules have been handed in.

Homework: Weekly problem sets are due *by 4:00 pm* every Friday, unless otherwise announced in class. See below for more detailed information.

Clinic: An *optional* (but highly recommended) problem-solving clinic will be held weekly; day, time, and location to be announced.

Textbook: *Modern Physics, 2rd Edition*, by Randy Harris.

Website: Homework, handouts, grades, and other information will be distributed via eLearning Commons: https://elc.uga.edu.

Prerequisites: PHYS 1212-1212L or PHYS 1312-1312L

Pre/Corequisites: MATH 2270 or MATH 2500 or MATH 3500 or MATH 3500H

Email: You are expected to check your email *daily* for course announcements.

Grading Policy

Grade components: Your semester average will be determined as follows:

- Cumulative final exam: 30%
- Three regular exams: 48%
  - Best 22%
  - Middle 16%
  - Worst 10%
- Homework average: 16%
- Reading quizzes: 6%

Letter grades: Ranges for letter grades will be *no worse for you* than the following:

A+	[Nonexistent]	B+	= [83-85)	C+	= [73-75)	D±	[Nonexistent]
A	= [87-100]	B	= [77-83)	C	= [67-73)	D	= [50-65)
A–	= [85-87)	B–	= [75-77)	C–	= [65-67)	F	= [0-50)

Here a square bracket means the end point is included in the range, and a round bracket (parenthesis) means the end point is not included in the range. Actual grade ranges may end up having lower cutoffs, depending on the overall level of performance.

Final exam grade boost: The comprehensive final exam is your opportunity to demonstrate that you have broadly and coherently mastered the course material. This is, after all, the main goal of the course. Therefore, I will give a grade boost for getting a higher grade on the final than for the semester as a whole, provided you haven't neglected the course during the semester. Here's how the boost works. At the end of the semester, I will calculate two letter grades for each student: one based on the formula given above ("formula-based grade") and one based *only* on the final exam ("final-exam grade"). If you meet ***all four*** of the following criteria, then the course grade I assign you will be one grade step higher than your formula-based grade (*e.g.*, B+ → A−); otherwise, your course grade will be your formula-based grade. The criteria for the grade boost are:

(a) you have not missed *any* regular exams,
(b) your regular-exam average is 65% or higher,
(c) your homework average is 65% or higher, *and*
(d) your final-exam grade is higher than your formula-based grade.

Regrade requests: Any requests for a regrade of an assignment, quiz, or exam must be made no later than one week after the graded item is returned. Any regrade requests made after this one-week window will be declined without further review. Keep in mind that a regrade may end up raising *or* lowering your score. Correcting arithmetic errors made in totaling up points does not count as a regrade and is not subject to the time limitations described above.

Borderline grades: Like any other measurement, grades possess a degree of uncertainty. Therefore, factors such as improvement *may* help borderline grades. (Lobbying, however, will not.) There is no extra credit in this course, so please don't ask.

'Incomplete' grades: According to UGA policy, a grade of Incomplete "indicates that a student was doing satisfactory work but, for non-academic reasons beyond his/her control, was unable to meet the full requirements of the course. An Incomplete should not ordinarily be given unless the student has completed a substantial part of the course. The instructor of the course should indicate to the student the deadline for completing the work in the course. No more than three semesters (counting summer school as one semester) may be allowed to complete the work in the course, but the instructor may specify an earlier deadline. If an I is not satisfactorily removed after three semesters (counting summer school as one semester), the symbol I will be changed to the grade F (or U for a course graded S/U) by the Registrar." I will adhere to this policy for this course.

Course withdrawal: Make sure you are familiar with the UGA policy on withdrawal from courses. You can find it online at the following URL:

http://bulletin.uga.edu/Bulletin_Files/acad/Courses.html

The withdrawal deadline for this semester is ~~**Monday, March 19**~~. Any student who is showing serious neglect for this course (*e.g.*, routinely failing to turn in homework on time, rarely attending class, etc.) may be asked to withdraw. A student missing 3 consecutive classes or failing to turn in 2 consecutive homework assignments, without adequate prior explanation, will be considered eligible for an instructor-initiated withdrawal from the course. All such cases will be brought to the attention of the student's academic advisor.

Exams

Number and rules: There will be three regular exams and a *comprehensive* final exam. They will all be closed-book and closed-notes. However, I may provide you with a sheet containing formulas, fundamental constants, etc. You may use a scientific calculator on exams *for arithmetic only*, not for algebra, calculus, graphing, or information storage; all programs and memory registers must be cleared. Unless told otherwise, you must show work on each exam problem in order to receive full credit.

Regular exams: Regular exams will be held in class. It is *essential* that you arrive on time for exams, as I will not be able to give you extra time at the end if you arrive late. The specific dates of the exams have not yet been determined, but I will give you at least one week notice. I will give you further information on each exam before the exam date. Solutions will be posted to eLC after each exam has been graded.

Missed exams: If you need to miss an exam for a *legitimate and documentable* reason, you must contact me before the exam if at all possible, or else as soon as possible after the exam. Arrangements for dealing with missed exams will be made *only* for cases involving legitimate, documentable reasons and *only* if you notify me in a timely fashion. If you are uncertain as to what constitutes a legitimate and documentable reason for missing an exam, please ask me.

Final exam schedule: ~~Friday, April 27, 12:00-3:00 PM in Room 327~~.

Homework

Logistics: There will be 9-11 problem sets. Each will be due at 4:00 PM on the due date given on the assignment sheet (usually a Friday), unless otherwise stated. The pace of the class and changes to the schedule may necessitate changes to the due dates, which will be announced in class (and probably by email and on eLC). Your write-ups should be either handed to me or placed in my mailbox in the main office (Room 201). *Do not* slide assignments under my office door. Detailed homework solutions will be posted to eLC after the homework is due.

Write-up format: The following rules must be adhered to for all write-ups handed in for credit: (a) Use letter-size (8½"×11") paper, not legal-size paper. (b) Do not hand in papers with "fringe" from spiral notebooks. (c) Staple your pages *in order* in the upper left corner. A stapler is available in the main office. Do not use paper clips, bent-over corners, etc. (d) Write your first and last name clearly in the upper right corner of the top page. (e) On the last page of your write-up, list all classmates you worked with and any sources you used other than the course textbook. (f) Write legibly so that the grader can read your work easily. Rule of thumb: If the person grading can't read it, then it's wrong.

Grading: Problem sets will be graded by a graduate student assigned as the grader for this course (I will grade exams) and returned to you in a timely fashion. Disputes about the grading should be directed to me, and I will act as the final arbiter. Homework problems will be graded not only for correctness of the end result, but also on process. Be sure to express, clearly and legibly, the reasoning for your solutions.

Dropping lowest two: If you complete the online student evaluation for this course during the official period at the end of the semester when the evaluations website is up, then I will drop your lowest two scores when calculating your homework average for semester grades. If you do not complete the evaluation, then all homework scores will be included in your homework average. This policy serves two functions: (a) it gives you an incentive to submit a course evaluation, and (b) it compensates for unavoidable circumstances that may prevent you from submitting homework on time (*e.g.*, illness, scheduled event, emergency, etc.). *Late problem sets will not be accepted without my prior authorization.*

Teamwork vs. plagiarism: Teamwork can be a very good way of learning, so I encourage you to interact with your classmates on homework. However, do not mistake teamwork for plagiarism; it is unacceptable, for example, to divvy up the problems and then swap solutions. The work you hand in *must be your own*, not copied, reworded, or paraphrased from someone else's work. I will choose problems from a variety of sources, including my own imagination. It is likely that solutions for many of the assigned problems can be found on the internet or other sources. I know this, and now you do too. It is unacceptable for you to solve homework problems by "mining" for existing solutions. Nor is it acceptable to consult existing solutions for hints. Both of these constitute forms of plagiarism. Remember, the only way you will learn the subject is by sweating through problems on your own and/or with your study team.

Final comment: Working physics problems is *by far* the best way to learn physics, so it is important that you make every effort to do an honest and thorough job.

Readings

Reading Assignments: Each week (except those in which exams are scheduled) there will be a reading assignment of 20-30 pages, which will be listed well in advance on eLC. All students are expected to complete a given week's reading assignment by the start of class on Monday of that week.

Rationale: There are two pedagogically important reasons to keep up with reading assignments: (a) Your time spent in class will be more meaningful and beneficial if you read the textbook *in advance*. Ample research shows that having some familiarity with the material to be discussed in class will help you focus on understanding the nuances and challenging concepts and techniques in a way that's not possible if the material is completely unfamiliar to you. (b) It is simply not possible to cover *in class* everything you need to learn. Fortunately it is not necessary to do so either, because there are plenty of things you are all fully capable of learning on your own through reading.

Reading Quizzes: To motivate you to complete reading assignments on time, there will be a brief (~5 minute) reading comprehension quiz *at the start of class* every Monday (except for weeks in which exams are scheduled). You will not be expected to have mastered the material for these quizzes, but rather to have comprehended what you were assigned to read. There is no making up reading quizzes. If you miss one (e.g., by arriving to class after the quiz is over), then you will get a zero on that week's quiz. However, I will drop your lowest two reading quiz scores of the semester.

Academic Honesty

The University of Georgia has a comprehensive policy on academic honesty known as *A Culture of Honesty*. This policy not only describes required and prohibited conduct, as pertains to academic honesty, but also provides a detailed procedure for resolving matters of alleged academic dishonesty, including a description of consequences for honesty violations. The complete policy can be found online at http://www.uga.edu/honesty/. All students are responsible for knowing, understanding, and abiding by this policy. If you have any questions about the appropriateness of your work in this course, you are obligated to ask me for clarification.

I take issues of academic honesty very seriously, and it is my responsibility to uphold the University's policy. This means, among other things, that I will not hesitate to report my suspicions of dishonesty (*e.g.*, plagiarism, unauthorized assistance, etc.) to the Office of Instruction. This extends not only to exams but also to reading quizzes and homework.

Disclaimer

Unexpected circumstances and concurrent course assessment may require changes to the rules and information contained in this syllabus. If so, such changes will be done as fairly as possible, and you will be kept informed of the changes and their causes.

Class	Date	Chapter	Reading	Topic
1	W 1/9	1, 2	1.1-1.2, 2.1-2.3	Introduction, Lorentz Transformation
2	F 1/11	2	2.4-2.5	Twin Paradox, Doppler Effect
3	M 1/14	2	2.6-2.7	Velocity and Momentum
4	W 1/16	2	2.9	Energy, The Light cone
5	F 1/18	2	2.10	The Fourth Dimension
	M 1/21			*Holiday*
6	W 1/23	3	3.1	Black-Body Radiation
7	F 1/25	3, *Review*	3.2	Photoelectric Effect
8	M 1/28	**Test 1**		**Chapters 1 and 2**
9	W 1/30	3	3.3-3.6	X-rays, Pair Production
10	F 2/1	4	4.1-4.2	Matter waves
11	W 2/4	4	4.3-4.5	Schrödinger Equation
12	W 2/6	4	4.7	The Uncertainty Principle
13	F 2/8	5	5.1-5.3	Bound states
14	M 2/11	5	5.4-5.5	Particle in a box
15	W 2/13	5	5.6	Finite Well
16	F 2/15	5	5.7	Harmonic Oscillator
17	M 2/18	5	5.8	Expectation Values
18	M 2/20	6	6.1	Barriers
19	F 2/22	*Review*		
20	M 2/25	**Test 2**		**Chapters 3-5**
21	W 2/27	6	6.2	Tunneling
22	F 3/1	6	6.3-6.4	Applications (*Mid term*)
23	W 3/4	7	4.6, 7.1	The Hydrogen Atom
24	W 3/6	7	7.3-7.4	The Hydrogen Atom
25	F 3/8	7	7.5-7.6	The H Atom (*withdraw. deadline*)
	3/11-15			*Spring Break*
26	M 3/18	7	7.7-7.8	The H atom
27	W 3/20	7	7.10	Photon emission
28	F 3/22	8	8.1-8.2	Spin and Symmetrization
29	M 3/25	8	8.3	Exclusion Princople
30	W 3/27	8	8.4	Multielectron atoms
31	F 3/29	8	8.6	Spin-orbit interaction
32	M 4/1	8	8.7	Momentum addition
33	W 4/3	8	8.8-8.9	External Fields, Spectra
34	F 4/5	9	9.1, 9.3	Boltzmann Distribution
35	M 4/8	9	9.4	Classical distributions
36	W 4/10	9	9.5-9.6	Quantum distributions
37	F 4/12	9	9.7-9.8	Bosons and lasers
38	M 4/15	10	10.1-10.3	Molecules
39	W 4/17	*Review*		
40	F 4/19	**Test 2**		**Chapters 6-9**
41	M 4/22	10	10.4-10.6	Solids
42	W 4/24	10	10.7-10.9	Semiconductors, Superconductors
43	F 4/26	11	11.1-11.3	Nuclear physics
44	M 4/29	*Final Review*		
	W 5/1			*Reading Day*
45	M 5/6	**Final Exam**	**Comprehensive**	12-3pm