

Physics 270: Electromagnetism, Light, Relativity and Modern Physics Sections 0301 to 0304 — Professor Shawhan — Fall 2014

The most up-to-date version of the syllabus can always be found on
the course web site, reachable via <http://ter.ps/shawhan270>

Contact information

Prof. Peter S. Shawhan, room 2120 in the Physical Sciences Complex (PSC) building,
pshawhan@umd.edu, 301-405-1580

Lectures: Mon, Wed, Fri 12:00-12:50 in room 1410 of the Physics Building

Office hours: normally Tue, Wed, Thu, Fri from 1:30-3:30. (Check course web site for exceptions)

If you have a question or issue that can't be handled during office hours, please email or call.

TA: Kyle Wardlow, room 3260 in the Physical Sciences Complex (PSC) building,
kwardlow@umd.edu, 301-405-6016

Office hours: TBD

Overview

As you know, this is the third and final semester of the general physics sequence designed for engineers. This is when things get interesting! To some extent, we will build on basic concepts that were covered in the previous two semesters, such as force and motion, oscillations, and electrical circuits. However, this course is more about rich topics that bring us up to the modern era: electrodynamics, Maxwell's equations and electromagnetic waves, classical geometric optics, wave optics (interference and diffraction), relativity, and quantum mechanics. These things enable most of the technologies that make modern life what it is, and tell us most of what we know about the universe around us.

This course will move quickly, and it is important for you to keep up! I will expect you to read the textbook—I'll tell you what sections, and try not to give you more than necessary—and attend the lectures and your scheduled discussion sessions. Participation will be factored in when calculating your course grade. My lectures will not simply repeat things that you can read in the textbook, and will often be interactive—please come ready to think and respond, not just to take notes! Homework each week will be a combination of online work and written-on-paper problems that you'll turn in in class. To do well in the course, it is up to you to make sure you fully understand everything we cover. I and the TAs will explain it as well as we can and help when you have questions, but real learning happens inside your head, not in front of your eyes.

Physics is fundamentally an experimental science—there is plenty of theory and mathematics, but everything is grounded in what happens in real life. The Engineering School and the Physics Department consider lab experiments to be an important part of your physics learning, but have organized them under a separate course number (PHYS 271) for scheduling flexibility. Both PHYS 270 and PHYS 271 must be taken in the same semester and the scores for the courses will be combined to calculate a single grade that will be entered for both courses. It is your responsibility to make sure that you are enrolled in both courses; note that total enrollment may be limited by the number of seats available in PHYS 271 even if there are seats available in PHYS 270. To pass, students must complete passing work in both PHYS 270 and PHYS 271. (If you are transferring a PHYS 271 score from a previous semester, let me know early in the semester.)

Required course materials

You will need four things for this course: the textbook, a subscription to the MasteringPhysics online tutorial/homework system, a subscription to the Learning Catalytics (LC) interactive response system, and a device you can bring to class to use Learning Catalytics. The first three of those can be obtained all together as a bundle, or separately. Read the information below carefully for options and advice.

The required textbook for this course is “Physics for Scientists and Engineers with Modern Physics: A Strategic Approach” by Randall D. Knight, published by Addison-Wesley/Pearson. The book is currently in its third edition, and that is the version that the bookstore is selling. Actually, the second edition of Knight is an acceptable substitute in my course and you might be able to get one cheap. See below for how to purchase MasteringPhysics and LC access separately if you are starting with a used copy of either the second or third edition.

If you are starting from scratch and like having a printed book, the easiest way to get all the things you need for the course is to buy the standard bundle, which contains a new copy of the textbook and a MasteringPhysics access code card that also gives you access to LC (integrated with MasteringPhysics). The purchase cost is around \$270, I think. The ISBN for this bundle is 9780321736086.

An alternative, if you don't feel you need a printed copy of the book, is to purchase MasteringPhysics with the eText option at masteringphysics.com. (This gives you integrated LC too.) The cost for that is \$110 online. However, I don't find the MasteringPhysics eText very easy to navigate through, and the eText expires after a couple of years. (A printed book, on the other hand, can be sold if you don't want it any more.)

But if you took PHYS 161 and/or PHYS 260 here at UMD and used MasteringPhysics, then you probably already have a copy of the book and still have MasteringPhysics access, and you may not have to buy anything more. Try logging in at masteringphysics.com and joining the course with ID “SHAWHAN2014”. If that succeeds and you're viewing the course home page, look along the right side for a “Learning Catalytics” link. Try clicking on that; if that gets you into LC, then you should be all set!

There are a couple reasons why that might not work for you. First of all, your MasteringPhysics access needs to be keyed to the Knight book, third edition, for you to be able to join the SHAWHAN2014 course; if you got your access code with some other book, including the second edition of Knight, it won't work with our course. Second, Learning Catalytics is integrated with MasteringPhysics only if you got the eText with your MasteringPhysics access. If you have MasteringPhysics but it does not have the eText and LC, then you can purchase a 6-month LC subscription for \$12 at learningcatalytics.com.

Finally, if you have a copy of the textbook (e.g., a used printed copy, or a non-Pearson eBook) but do not have working MasteringPhysics/LC access, you can purchase MasteringPhysics access without the eText for \$66 at masteringphysics.com and LC for \$12 at learningcatalytics.com.

In any case, to use Learning Catalytics, you will need to bring a smartphone, tablet, iPod Touch or laptop to each class to use the service to participate in the questions and group activities. (If you're not able to bring one of those devices to class, please contact me to discuss this.)

Course grade calculation

Your scores from the different parts of Physics 270 will be combined as follows:

5%	Participation (lecture interactions, discussion attendance, end-of-semester survey)
20%	Homework (including online and written-on-paper parts)
45%	Midterm exams (15% each)
30%	Final exam

Participation scores will allow for missing up to three class sessions and one discussion meeting with no deduction, no excuse needed. However, please make sure I'm aware of any excused absences, e.g. for illness. No homework or midterm exam scores will be dropped—all will be used to calculate your grade. Finally, your overall PHYS 270 score will be combined with your PHYS 271 (lab) score to calculate the letter grade that will be submitted for both courses.

Course policies

Late or missed work:

Assignments must be completed and turned in when they are due unless you have a valid excuse according to university policy, e.g. illness, in which case an extension will be granted. Please let **me** (not just your TA) know your situation as soon as possible, and I will tell you if I need documentation for the reason for your absence. In general, no credit will be given for work turned in late without a valid excuse, but contact me if there is some special case. In the case of illness, we will follow the university policy posted at <http://www.president.umd.edu/policies/v100g.html>: The *first* time you miss a due date during the semester, I will accept a self-signed note from you (without a doctor's note) explaining the dates of your illness and stating that the information is true and correct. If illness causes you to miss more than one due date during the semester, or to miss an exam, I will require a doctor's note. If you do miss an exam, I will schedule a make-up time with you as soon as possible—it starts to cause problems if it's more than a few days later. In any case, whatever the reason for your absence, it is important that you contact me as soon as you reasonably can.

Policy on collaborating:

Working together with other students is part of the course, e.g. in the lectures, discussions, and PHYS 271 labs. Working together to study and figure out the homework is also encouraged, but you must do and turn in **your own work!** This simple rule applies: **Never look at someone else's written solution** (on paper, a blackboard, or a screen). That applies to your classmates as well as anything you find on the web. Talking about how to work the problem is fine if it helps you to understand it better, but copying a solution is strictly forbidden (and will not enable you to succeed on the exams). Work that appears to have been copied will receive zero credit and may lead to an academic integrity referral (see below).

Honor Code:

The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. I will ask you to sign the Honor Pledge on exams; I won't ask you to sign it on each homework assignment, but it should be understood that the Honor Code still applies to homework. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. Violations will be taken very seriously and may result in

an XF grade for the course and possible suspension. As your teacher, I have an obligation to uphold the Honor Code and have had to submit some Academic Integrity Referrals over the past few years, unfortunately, which led to XF grades. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://shc.umd.edu/SHC/Default.aspx> .

Religious observances:

If you need to miss class, discussion, a homework deadline, or an exam due to a religious observance, please notify me in advance—preferably at the beginning of the semester—so that we can make appropriate arrangements.

Students with disabilities:

Accommodations will be provided to enable students with documented disabilities to participate fully in the course. Please discuss any needs with me at the beginning of the semester so that appropriate arrangements can be made.

Weather or emergency closures:

If the University is closed due to weather or some emergency situation on a day when homework is due, then that homework must be turned in at the beginning of the next class when the University is open. If the University is closed on the scheduled date of an exam, then the exam will be given during the next class period when the University is open. If the University is closed on any non-exam day, including just before an exam, then the exam will still be given according to the original schedule. If for some reason the University is closed for an extended period, I will continue the course by recording video lectures and posting them on the web, and will ask you to watch them, read, and do homework assignments on your own. In these or other exceptional circumstances, I will attempt to send out information by email.

Course announcements by email:

I will occasionally send important announcements to the class, specifically to each student's **umd.edu** email address. If you use some other email system, please make sure that mail sent to your umd.edu address is successfully forwarded to the address you use most regularly.

Privacy:

You have a right to privacy of your educational records, including the fact that you are enrolled in this course, but I hope you won't mind if the TAs and I may call you by name in the presence of other students, and hand back graded papers in class. If that may be an issue or if you are ever uncomfortable with the class environment, please don't hesitate to let me know.

Help Resources (in addition to discussion meetings and office hours)

I have created a Piazza online discussion forum for our course. As you may know, Piazza is a completely free service. If you have a question that you'd like to ask your peers, I encourage you to post it on Piazza -- that way you can get a reply at any hour of the day or night. Naturally, if you see a question posted and have a good answer or comment to contribute, please do so! Just remember that the **Policy on collaborating** applies to online communications too... Also, the TAs and I might step in too if there is something we think we can clarify. You can even post anonymously if you want (though the TAs and I will still know who made the post). We will also post announcements on Piazza from time to time, so it's important that you be registered.

The Slawsky Physics Clinic is staffed by volunteers who offer free assistance with studying and homework, typically Monday through Friday from 10:00 to 3:00. The Clinic is located in room 1214 in the Toll Physics Building.

If you are interested in hiring a private tutor, the Physics Department maintains a list of people who offer such services – see <http://umdphysics.umd.edu/academics/tutoring-a-academic-support.html> .

Note: Although you may get help in many forms, remember the **Policy on collaborating** described above! Please remind the people you are working with that they should explain and help you learn, not simply show you the answer to a problem, since you are not allowed to copy anyone else's written answer (and you wouldn't learn much, if anything, from it). Also, it is ultimately your responsibility to understand and arrive at (your own) correct answers. There is not much I can do if someone else gives you an ambiguous or incorrect line of reasoning, and even professionals make mistakes from time to time. Therefore, receive help with a healthy skepticism and cross-check your understanding to make sure it really holds together.

If you are experiencing difficulties in keeping up with the academic demands of this course and/or your overall course load, I encourage you to contact the Learning Assistance Service, 2202 Shoemaker Building, 301-314-7693. Their educational counselors can help with time management, reading, math learning skills, note-taking and exam preparation skills. All of their services are free to UMD students.

Copyright Protection of Course Materials

I hope you get a lot out of this course, but not by taking and selling the course materials! ☺ Please understand that my lecture slides, handouts, homework and exam problems and solutions, and the lectures themselves (including any audio or video recordings) are copyrighted by me and/or by other people and may not be distributed or reproduced without explicit permission.

Physics 270 Course Schedule

Fall 2014 — Professor Shawhan

<i>Homework due:</i>				<i>Book sections</i>	
<i>Online</i>	<i>Paper</i>	<i>Lecture topic(s)</i>		<i>(Knight 3rd ed.)</i>	<i>(Knight 2nd ed.)</i>
		Sep 3	Course intro; Magnets	32.1-2	33.1-2
		Sep 5	Magnetic force on charged particles	32.7	33.7
Sep 7	Sep 8	Sep 8	Applications of magnetic force	32.8-9	33.8-9
		Sep 10	Generation of magnetic field: Biot-Savart law	32.3-5	33.3-5
		Sep 12	Calculation of magnetic field: Ampere's law	32.6	33.6
Sep 14	Sep 15	Sep 15	Magnetic properties of materials	32.10+lecture	33.10+lecture
		Sep 17	Magnetically induced currents	33.1-3	34.1-3
		Sep 19	Faraday's Law and Lenz's Law	33.4-6	34.4-6
Sep 21	Sep 22	Sep 22	Applications of induction; Review of circuits	33.7, Ch. 31	34.7, Ch. 32
		Sep 24	Inductance; Transformers	33.8	34.8
		Sep 26	RC and LC circuits	31.9, 33.9	32.9, 34.9
Sep 28	Sep 29	Sep 29	RL and RLC circuits; Alternating current	33.10, 35.1	34.10, 36.1
		Oct 1	Driven AC circuits	35.2-35.5	36.2-36.5
		Oct 3	Discussion		
Oct 5	Oct 6	Oct 6	Exam 1		
		Oct 8	Maxwell's equations	34.2-4	35.2-4
		Oct 10	Electromagnetic waves and their properties	34.5-7	35.5-7
Oct 12	Oct 13	Oct 13	Foundations of relativity	34.1, 36.1-4	35.1, 37.1-4
		Oct 15	Implications: time dilation, length contraction	36.6-7	37.6-7
		Oct 17	Lorentz transform; Addition of velocities	36.8	37.8
Oct 19	Oct 20	Oct 20	Relativistic momentum and energy	36.9-10	37.9-10
		Oct 22	General relativity	lecture	lecture
		Oct 24	Light and reflections	23.1-2	23.1-2
Oct 26	Oct 27	Oct 27	Refraction and total internal reflection	23.3-4	23.3-4
		Oct 29	Lenses	23.6-7	23.6-7
		Oct 31	Discussion		
Nov 2	Nov 3	Nov 3	Exam 2		
		Nov 5	Optical assemblies	24.1-3	24.1-3
		Nov 7	Optical instruments	24.4-5	24.4-5
Nov 9	Nov 10	Nov 10	Interference of light	22.1-2	22.1-2
		Nov 12	Diffraction	22.3-5	22.3-5
		Nov 14	Applications of interference and diffraction	22.6	22.6
Nov 16	Nov 17	Nov 17	Breakdown of classical physics: radiation	37.1-2	38.1, 38.8
		Nov 19	The photoelectric effect	38.1-3	39.1-3
		Nov 21	The wave nature of matter	39.1-2, 39.5-6	40.1-2, 40.5-6
Nov 23	Nov 24	Nov 24	Schrödinger quantum mechanics	40.1-2, 40.7	41.1-2, 41.7
		Nov 26	Particles in potential wells	40.3-6	41.3-6
		Nov 28	** Thanksgiving holiday — No class **		
Dec 2	Dec 3	Dec 1	Quantum harmonic oscillator; Tunneling	40.8, 40.10	41.8, 41.10
		Dec 3	Lasers; Discussion	41.8	42.8
		Dec 5	Exam 3		
Dec 11	Dec 12	Dec 8	Atomic spectra and applications	38.6-7, 41.6	39.6-7, 42.6
		Dec 10	Cosmology and nucleosynthesis	lecture	lecture
		Dec 12	Course review and discussion		
		TBD	Common final exam, date and time TBD		