Physics 202 Electricity and Magnetism Fall 2022

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Class Times: MWF 9:40-10:40 (Trout 106)
Office Hrs: MWF 11:00-11:30 and 3:00-3:30
T/Th 1:30-3:00
(15-min Zoom appts at calendly.com/daniel_robb)

Course Description:
Continuation of PHYS 201; electricity and magnetism, circuits, and some applications of classical physics.

Textbook:
• *Physics for Scientists and Engineers,* by Serway and Jewett, 8th edition, ISBN-13 978-0495827818
(You may use the 9th or 10th edition if you prefer; I have chosen this edition to keep costs down.)

Purpose of the Course:
You will learn about the nature of electricity and magnetism. These are two of the three fundamental forces through which everything in the universe interacts. (Well, everything bigger than an atomic nucleus, anyway!) These forces act within the framework of Newtonian mechanics, which you studied in PHYS 201. In addition, you will learn how electricity and magnetism concepts manifest themselves in the understanding of the behavior of electric circuits. The analytical and mathematical skills you gain in the process will make you a more effective problem-solver in your chosen field.

Specific Goals of the Course:
1. to understand the principles of electricity, magnetism, and basic DC and AC circuits.
2. to become familiar with several examples of modern technology based on these principles.
3. to further develop your analytical skills by solving quantitative problems in a structured way.

You will not need to memorize equations in this course. *In fact, you will be given all the equations you need on the tests*! You will learn to think carefully about the situation described in a problem, applying your knowledge of physics concepts to determine a strategy. The equations to use will follow naturally from a correct conceptual analysis of the problem.

Academic Integrity:
There are no shortcuts to learning physics well. I will follow the college Academic Integrity policy, and you are responsible for knowing and following the college policy. Assigned homework problems may be discussed with others, but you should not take the entire solution process from another person, and you must formulate and write up solutions on your own. Be aware that I am contractually obligated to report students if I suspect that they have engaged in academic dishonesty. Lastly, unless otherwise directed, cell phones should be silenced and out of sight during all class periods.

Policy on Late Work:
The course material is cumulative, so it's important for you to receive rapid feedback on your work. Thus, quiz solutions and graded quizzes will be available by the next class period after the quiz is taken. If you have an illness or excused absence which truly prevents you from taking a quiz, and notify me **beforehand**, I will generally exempt you from the quiz. Please see the laboratory syllabus for the policy on late labs.

Methods of Instruction:
The concepts of electricity and magnetism are interesting, but can be challenging. This course is designed to provide multiple passes through the material, with opportunities to improve understanding with each pass.
First pass:
You are expected to do relevant textbook readings ***before class***. You are not expected to understand everything in the reading, but you should make an effort, and try to pinpoint areas of confusion.
Second pass:
Research has shown that physics students learn better when class time is spent on interactive activities designed to improve conceptual understanding, rather than on direct lecturing. So I generally will not cover the entire reading during lecture. Instead, I will present the main concept, then we'll work several in-class conceptual questions, during which you will both think individually and discuss with your neighbors.
Third pass:
To really master physics, there's no substitute for applying physics concepts to new problems. This is often not easy, but grappling with new problems is where you will make the most actual gains in your understanding. A set of homework problems will be posted on Inquire on Wednesdays and Fridays, and a 5-minute in-class, open-notes quiz -- consisting of one of these homework problems -- will be given on Mondays and Wednesdays. Quiz solutions will be available on Inquire by the following class period, and graded quizzes will be returned the following class period.
Further resources:
(1) You will ground your understanding in the laboratories; every effort is being made to schedule the laboratory experiments so they reinforce the course material.
2) We will devote the last 15-20 minutes of class periods to Python programming projects on relevant course topics. No previous Python experience is assumed, and you will work together in pairs ('pair coding') with instructor help available. Programming can lead to deeper physical insight into the material.
(3) You are encouraged to use office hours to discuss the material, especially if you are having trouble.

Attendance Policy:
If you have a temperature of 100.4 or higher or other coronavirus symptoms, don't come to class. Call Health Services IMMEDIATELY. Do not come to class or go to any public area on campus. In order for your absence to be excused, you must give Health Services permission to notify me that you have consulted them about coronavirus symptoms. If Health Services informs you that you should isolate and not attend class for multiple days, contact me so that we can make a plan to keep you current in the course. All absences caused by consultation with Health Services about coronavirus symptoms or isolation ordered by Health Services will be excused, but you will need to do the work and graded assignments even if we extend a deadline for you.

The following is the course policy for all other absences. You are expected to attend every class. Attendance is checked at each class meeting, and you must be in class to participate in the in-class activities which form part of the class participation grade. If you are going to be absent from class for a valid (excused) reason, I must be notified in advance. Your fourth and each additional unexcused absence will result in a 2-point deduction in your final course grade. Furthermore, you are accountable for all work missed because of any absence. I will provide class materials for a missed class, but will not re-teach a missed class during office hours.

Mask Policy
The College is starting the term without a specific mask mandate. I am not requiring masks in class, but you may wear certainly wear a mask in class if you choose to.

Make-up Tests:
Make-up tests will not be given. If you miss a test, and have an official college excuse for that absence, then your final exam grade will count for the missed test. If your test absence is unexcused, you will receive a zero.

Feedback and Evaluation:

You should expect to receive a final grade of "A" for 93-100, an "A-" for 90-93, a "B+" for 87-90, a "B" for 83-87, etc. I may tweak final grades slightly based on the distribution of numerical grades and my perception of your effort in the course. These are the categories and percentages that will be used:

Tests:	30% (3 @ 10 % each)	Final Exam:	15%
Lab Grade:	20%	Programming Projects:	10%
HW-Based Quizzes:	20%	MCSP Conversation Series:	5%

Tests will be given during class on the dates indicated. *You will be given all needed equations on the test,* though the equations will not be labeled. The final exam has the same format as the tests, and is comprehensive.

Lab grade: Please see the lab class syllabus for information on the lab grade.

HW-Based Quizzes are 5-minute quizzes given at the start of class on Mondays and Wednesdays. The quizzes are open book and open notes. The quiz question will be drawn from a set of assigned homework problems given out two class periods in advance. You may write up solutions to these assigned problems as part of your notes and refer to them during the quiz. Note that in working assigned homework problems, you may discuss general concept(s) involved in a problem with a classmate, but you may not discuss specifics of the solution process. Emphasis in grading the HW-based quizzes will be on the visual and written steps in the solution process –partial credit may be received even if a final numerical answer is incorrect. Graded quizzes will be returned the following class period, and quiz solutions will be available on Inquire by the following class period.

Programming Projects will result in Python programs or Jupyter Python notebooks uploaded to Inquire, which will be evaluated for (i) effort/completeness and (ii) correctness/effectiveness on the given physics problem.

MSCP Conversation Series reports are completed by attending a talk in the MSCP Conversation Series (see https://www.roanoke.edu/inside/a-z_index/math_cs_and_physics/conversation_series/fall_2022), and submitting a paper, which should contain: (i) a brief summary of key ideas of the talk ; (ii) a description of parts of the talk that were interesting or confusing; (iii) your justified critique, including the level of presentation and the content. **The paper is due (by upload using Turnitin on our course Inquire site) no later than a week after the talk**. It should be word-processed, single-spaced, and approximately one page, and use proper grammar.

Use of Electronic Devices:

In class, you may use personal laptops, but only for course-related purposes. All other electronic devices must be turned off. On tests, you may use a scientific calculator; all other electronic devices must be turned off and out of sight. Violation of this policy on tests will be treated as a violation of the Academic Integrity policy.

Accessible Education Services:

Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Becky Harman at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester. If you are on record with AES as having academic or physical needs requiring accommodations, please contact me as soon as possible. We need to discuss your accommodations before they can be implemented. Also, please note that arrangements for extended time on exams and/or testing in a semi-private setting must be made at least one week ***before every exam.***

Course schedule

#	Date	Topic	Reading	Computation	Labs
1	Aug. 31	Intro; Simple harmonic motion	15.1,15.2	Using Python in Physics	
2	Sept. 2	Energy of SHO, Pendulum	15.3,15.4,15.5	"	1: No Lab
3*	5	Traveling wave, properties	16.1,16.2,16.3	"	
4*	7	Damped/forced osc's, wave equation	15.6,15.7,16.6	"	
5	9	Sound waves, Doppler effect	17.1 – 17.4	"	2: Standing Waves
6*	12	Interference, standing waves	18.1,18.2,18.3	"	
7*	14	Resonance and air columns	18.4,18.5,18.6	Plane rigid pendulum	
8	16	Beat patterns, non-sinusoidal waves	18.7,18.8	"	3: E charge/force
9*	19	E Charge, Coulomb's Law	23.1,23.2,23.3	"	
10*	21	Continuous charge distribution	23.5	"	
11	23	E field and E field lines	23.6,23.7	"	Exam 1 Review
12*	26	E flux	24.1	"	
13*	28	Gauss's Law & Applications	24.2,24.3	"	
14	30	**TEST 1**		None	4: E field/flux
15*	Oct. 3	Electric potential	25.1,25.2,25.3	E Field of Charged Rod	
16*	5	E Field from potential, Equipotentials	25.4	"	
17	7	Potential of continuous distributions	25.5	"	5: E field/potential
18*	10	Capacitance	26.1,26.2	"	
19*	12	Capacitor network rules	26.3,26.4	"	
20	14	Dielectrics	26.5,26.6,26.7	"	6: Intro to capacitors
	15-23	**FALL BREAK**		None	
21	24	Electric current & resistance	27.1,27.2	E Field of Charged Ring	
22*	26	Temp effects, superconductivity	27.4,27.5	"	
23	28	EMF, Effective resistance	28.1,28.2	"	7: Electric circuits
24*	31	Kirchoff Laws, RC Circuits	28.3,28.4	"	
25*	Nov. 2	Magnetic field, force	29.1	"	
26	4	No class		None	Exam 2 Review
27	7	**TEST 2**		None	
28*	9	Motion of charged particle in B field	29.2,29.3	Motion of particle in B	
29	11	B force on current-carrying wire	29.4	"	8: Mapping B field
30*	14	B torque and applications	29.5,29.6	"	
31*	16	Biot-Savart Law, Ampere's Law	30.1,30.2,30.3	"	
32	18	Gauss's Law of Magnetism	30.4,30.5,30.6	"	9: Biot-Savart law
33*	21	Faraday's Law	31.1	Finding B using Biot-Savart	
	23-27	**THANKSGIVING BREAK**		None	
34	28	Motional EMF, Lenz's Law	31.2,31.3	"	
35*	30	Generators and Motors	31.5	"	
36	Dec. 2	Self-induction, LR circuits	32.1,32.2	"	Exam 3 Review
37*	5	Energy in B field, LC circuits	32.3,32.4,32.5	"	
38	7	**TEST 3**		None	
39	9	Review & Catchup		Finding B using Biot-Savart	Make up lab
		FINAL: Wed, Dec 14, 8:30-11:30am			

Note: Including the lab, you should expect to spend a combined total of about 18 hrs/week on this course.
Note: Class numbers marked with an asterisk will begin with a 5-minute HW-based quiz.