

Instructor: Daniel Robb

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Class Times: MWF 9:40-10:40 (Trexler 272)

Office Hrs: T/Th 1:00-3:00 (15 min Zoom appts)

(Make appts at [calendly.com/daniel\\_robbs](https://calendly.com/daniel_robbs))

### **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, 8<sup>th</sup> 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. ExpertTA problems may be discussed with others, but you should not take the entire solution process from another person, and you must formulate your solution 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, solutions to Expert TA problems will be available shortly after the class in which they are due. If you have an illness or excused absence which prevents you from doing an Expert TA problem, and notify me **beforehand**, I will generally exempt you. Please see the laboratory syllabus for the policy on late labs.

### **Methods of Instruction:**

The concepts of electricity, magnetism, and circuits are interesting, but they can be challenging to absorb. As a result, this course is designed to provide you with multiple passes through the material, with feedback and opportunities to improve your understanding during each pass.

#### **First pass:**

You will be expected to do the assigned textbook readings *before class*. You are not expected to understand everything in the reading, but you should make an effort to understand, 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 on the textbook material. So I generally will not cover the entire reading during lecture. Instead, I will present the main concepts. Then we'll work on several in-class conceptual questions, during which you will both think individually and discuss the questions with your neighbors. Depending on the time available, I may work a demo problem illustrating the day's material and problem-solving techniques.

#### **Third pass:**

To really master physics, there's no substitute for trying to apply 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. Online Expert TA problems will be due by 9:00 am on the day of most classes. Access to the Expert TA system costs \$32.50 for one semester. Instructions for buying access will be emailed to you, and posted on the course Inquire page. You will be allowed several attempts at solving the Expert TA Problems correctly; since the problems cover recent material, the grading scale is fairly lenient. Solutions will be available shortly after class.

#### **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) 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. Do keep up with all readings, assignments, and deadlines. 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 or weeks, please contact me so that we can formulate 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.

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 has issued a mask mandate for the start of the semester that requires masks to be worn in indoor common spaces such as our classroom. You must wear a mask in this class. If you arrive without a mask, you will not be allowed to stay and may lose credit for attendance or in-class work. The Bookstore sells masks if you need to make a quick purchase. If the mandate is extended, you will be required to continue to wear a mask.

### **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 will assign +/- to your final grades by examining the distribution of grades and taking into account my perception of your effort in the course. These are the categories and percentages that will be used:

<u>Tests:</u>	30% (3 @ 10 % each)	<u>Final Exam:</u>	20%
<u>Lab Grade:</u>	25%	<u>MCSP Conversation Series:</u>	5%
<u>ExpertTA Homework:</u>	20%		

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 on the test. 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.

Expert TA Homework assignments are daily assignments, due by 9:00 am the day of class, designed to give you practice on the concepts. You may discuss the general concept(s) involved in a given Expert TA problem with a classmate, but you may not discuss specifics of the solution process.

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\\_2021](https://www.roanoke.edu/inside/a-z_index/math_cs_and_physics/conversation_series/fall_2021) ), and submitting a well-written reflection paper. The paper should contain: (i) a brief summary of the key ideas of the talk ; (ii) a description of parts of the talk that were interesting, confusing, or relevant to PHYS 202; (iii) your justified critique, including the level of presentation and the content. **The MCSP paper is due (by upload using Turnitin on our course Inquire site) no later than one week after the virtual talk is presented.** The paper must be word-processed, single-spaced, approximately one page in length, and use proper grammar.

### **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 on the missed test.

### **Use of Electronic Devices:**

In class, you may use personal laptops, but only for the purpose of taking notes. 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](mailto: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	Chapter(s)	Laboratories
1	Sept. 1	Intro; Simple harmonic motion	15	
2	3	Energy of SHO, Pendulum		Lab 1: Simple Harmonic Motion
3	6	Traveling wave, properties	16 & 17	
4	8	Linear wave equation		
5	10	Sound waves, Doppler effect		Lab 2: Simple Harmonic Oscillator
6	13	Boundary conditions; interference	18	
7	15	Superposition principle, standing waves		
8	17	Air columns		Lab 3: Resonance
9	20	Electric charge (in motion), Coulomb's Law	23	
10	22	Continuous charge distribution		
11	24	Electric field and electric field lines		Exam 1 Review
12	27	Electric flux	24	
13	29	Gauss's Law and Applications		
14	Oct. 1	<b>TEST 1</b>		Lab 4: Electric Field/Potential
15	4	Electric potential	25	
16	6	Potential due to charge distribution		
17	8	(continued)		Lab 5 :Resistance Heating
18	11	Capacitors, Capacitance	26	
19	13	Capacitor network rules		
20	15	No class		Lab 6: Electrical Circuits
	16-24	<b>FALL BREAK</b>		
21	25	Capacitor applications		
22	27	Electric current and resistance	27	
23	29	Temperature effects		Lab 7: Magnetism
24	Nov. 1	EMF, Effective resistance	28	
25	3	Kirchoff's Laws, RC Circuits		
26	5	<b>TEST 2</b>		Exam 2 Review
27	8	Magnetic field, force	29	
28	10	Motion of charged particle in B field, applications		
29	12	Magnetic force on current-carrying conductor		Lab 8: Biot-Savart Law
30	15	Magnetic torque and applications	30	
31	17	Biot-Savart Law, Ampere's Law		
32	19	Gauss's Law of Magnetism		Lab 9: Ray Optics
33	22	Faraday's Law	31	
	24-28	<b>THANKSGIVING BREAK</b>		
34	29	Lenz's Law		
35	1	Generators and Motors		
36	3	Self-induction and LR circuits	32	Exam 3 Review
37	6	Energy in a magnetic field, LC circuits		
38	8	<b>TEST 3</b>		
39	10	Review and Catchup		Make up lab
		<b>FINAL: Wednesday, December 15, 8:30-11:30am</b>		

Note: Including the lab, you should expect to spend a combined total of about 18 hrs/week on this course.