Physics 202: Electricity & Magnetism
Fall 2019

Meeting: Trexler 263 — Time: MWF 9:40 – 10:40am
Instructor: Matthew C. Fleenor — Office: Trexler 266D
email: fleenor@roanoke.edu — Office Hours: MW 2.30–4.30pm or by appt.

webspace: faculty.roanoke.edu/fleenor/index.html

Required Textbook: *Physics for Scientists and Engineers*, 8th ed., Serway & Jewett, ISBN13: 978-0-49582781-8

Required Prerequisites: Physics 201 and Math 122 (Calculus II)

Learning Components

Aspiration: Remember, physics is as much a means for observing the universe as well as explaining the phenomena within it. A few different levels of interpretation exist for the sentence, "I understand physics, or I understand Maxwell's equations" (right?). My approach will continue with a 'both/and' mentality, where both the conceptual understanding (and appreciation!) and the analytical problem-solving approach can mutually coexist. I will attempt to provide the proper atmosphere and avenues so that neither of these necessary levels of understanding need to be sacrificed. My goal for you is that you will walk away with a deeper understanding in each of these contexts.

I am excited to continue our journey as we gather tools to understand the processes of the physical world. Unlike last semester when we focused on individual objects and their motion from one point to another point, the phenomena within this semester will relate to that which is more pervasive and periodic. This is especially true with the electromagnetic field, which is both periodic and pervasive. However, before moving to the composite understanding of one electromagnetic field, we will endeavor to explain the effects of the electric field and the magnetic field separately. Underlying our entire discussion for the semester are the physical characteristics of wave phenomena and properties of periodic motion.

Expected Learning Objectives: Sucessful students will – **1.** demonstrate a proficiency with the use of units and estimation;

2. display a working knowledge of the relationships involving periodic and wave motion;

3. manipulate common problems involving individual charges and conductors;

4. analyze various geometric arrangements of individual and continuous charge utilizing Gauss' law;

5. examine and decompose dc circuits for their effective resistance;

6. utilize Kirchoff's rules to solve dc circuits with multiple sources;

7. correctly predict the direction of current and forces for wires in an applied magnetic field;

8. demonstrate a proficiency in determining the net magnetic force using rules of superposition;

9. derive the exponential dependence of non-linear circuit elements from the differential equation;

10. calculate the potential difference and electrical potential energy from a static distribution of charges.

Attendance: Although roll will not be taken, daily attendance is expected. Due to the mathematically rigorous nature of the course, you may not miss more than *four* classes without a legal excuse (court, hospital, police, etc.). On the fourth absence, I will send an email to your advisor and the Registrar to alert them of the situation. Late arrivals greater than 10 minutes will constitute an official absence. The fifth absence for which there is no legal excuse will constitute your (forced) withdrawal from the course.

Office Hours: Please take advantage of the office hours prescribed above, or make an appointment with me. Drop-ins are at the total mercy of my daily schedule.

Inquire (NQR**):** The information found within the NQR environment is an essential component to the course itself. Notes, announcements, assignments (and *solutions*), links, and course documents will all be placed within the course NQR. Please do NOT forget to check NQR before you come to class or if you have a question about previous assignments.

Academic Integrity: I want to foster a mutual respect for the classroom hours that we have together. Please remember to turn off cell phones, PDAs, etc. during the class and come prepared. Refer to the "Academic Integrity" page on the RC website– http://roanoke.edu/A-Z_Index/Registrar/Policies_and_Information/Academic_Integrity.htm

Included here is an explanation of how violations of the College's academic integrity policy are handled.

Subject Tutoring: Subject Tutoring, located on the lower level of Fintel Library (Room 5), is open 4 pm– 9 pm, Sunday–Thursday. We are a Level II Internationally Certified Training Center through the College Reading and Learning Association (CRLA). Subject Tutors are highly trained Roanoke College students who offer one-on-one tutorials in a variety of general education and major courses such as:Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, INQ 250, and Social Sciences (see all available subjects at www.roanoke.edu/tutoring). Tutoring sessions are available in 15, 30, or 45-minute appointments. Feel free to drop by for a quick question or make an appointment at www.roanoke.edu/tutoring for a longer one-on-one appointment. For questions or concerns, please contact us at 540-375-2590 or subject tutoring@roanoke.edu.

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 documenteddisabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentationof a disability along with recommendations from the qualified specialist. Please contact Laura Leonard, 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 Laura Leonard at your earliest convenience to schedule an appointment.

Diversity: I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability and other visible and nonvisible differences.

All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Preferred Name/Pronoun: I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Grades: Standard letter grades (A–F) are assigned according to the following scale for this course: "A"(91–100), "B+"(88–90), "B"(83–87), "B–"(80–82), "C+"(78–79), "C"(74–78), "C–"(70-73), "D"(60– 69), "F"(< 60).

Grading Rubric

Your grade is determined according to the following distribution:

Exams (3)	30%	Homework	20%
Final	15%	Participation	5%
Lab (202L)	20%	Quiz (weekly)	10%

Grading Components

Exams: All exams are planned (by me) for completion in 1.0 hour, however, you will have up to 1.25 hours to complete each exam. Since the class begins at 9.40 a.m., each student has the option to arrive at 9.30 a.m. and begin the exam or hold the exam until 10.50 a.m. NOTE: If you have a class that begins at 10.50, it is *your* responsibility to plan for the late arrival into your next class. All exams will contain comprehensive material from the previous chapters, most probably the one/two *most* missed problems from the previous exam/quizzes. The final exam will be given in class and will be cumulative. Make-up exams will only be allowed as a result of a discussion with me **beforehand** or a note related to the emergency (death, hospitalization, misdemeanor, etc.) *signed* by a governing official (medical doctor, parent, law enforcer, etc.).

Quizzes: Weekly quizzes (FRIs) are completed individually or as a small group (my discretion) in class and graded. The quiz will consist of one partial problem from the class discussion, which contain the *more* important concepts and/or phenomena. Typically, the problem will not be numerical in nature.

Problem Sets: Un-/assigned problems (like those in the problem sets) are "**when and where**" you will learn the course material. For better and for worse, there is no way to learn the depth of the material within the one-hour sessions that we will have together. Due to the nature of problem solving, I expect that you will work together *toward* a solution. However, I also expect that you will create an original solution to each assigned problem. Substitutions and simplifications should **NOT** be left to the "reader" (that's me) to figure out. If necessary, words and phrases need to be properly placed so that I can follow your train of thought. Problem sets are your final draft essays and/or compositions that display the fruit of your higher-level critical thinking skills, so you need to view them in that light. These can be completed in electronic format or by-hand (neatly). If you do not follow these guidelines, I will return them to you for completion. I can provide examples of the kind of work that I expect on a final submission for the problem sets.

Labs: Physics exists because there is a connection between the mathematical world of symbols and the empirical world of measurement. Verifying the mathematical results of physical theory is an important component of the course. Creating words and sentences that express the results of experimentation is an extremely underrated (yet important) component of carrying out the enterprise of science. To think that you can carry out significant experimentation without adequate writing skills is foolish.

Participation: What it means to "participate" in Physics 202 could include the following: on-line quiz completion, listening (and responding) to audio-video lectures, attentive attendance, engagement in question and answer, working on in-class problems, completion of the "failure rubric", reflective write-up for two extracurricular lecture or presentations, and responsibility for your own learning (office hours, etc.).

Course Outline

Please see the Outline on the following page for the exact dates of meeting for the course. The Outline also shows the daily activity and course content for our educational experience. If you have questions about scheduling, please refer to this Outline first.

PHYS 202 Course Outline: Fall 2019

Week	Date	Sections	Topic	Problem	Laboratory
1	26-Aug 28-Aug 30-Aug	15.1 – 15.2 15.4	Simple harmonic motion **Quiz 1/** Circular motion and SHO	15.09 Handout/DifE	
2	2-Sep 4-Sep 6-Sep	16.1 – 16.2 16.3 – 16.4 18.1 – 18.2	Wave Propagation & Traveling Waves Speed, Reflection, and Transmission **Quiz 2/** Superposition, Standing Waves	15.52 16.4 16.29	Simple Harm. Oscil
3	9-Sep 11-Sep 13-Sep	18.3 23.1 – 23.3 23.3 – 23.4	Waves Under Boundary Conditions Electric Charge & Coulomb Law **Quiz 3/** Electric Fields	18.13 18.18, 18.19 23.1	Standing Waves
4	16-Sep 18-Sep 20-Sep	23.4 – 23.5 23.5 – 23.7 ***Exam 1: In-class (Chap. 15, 16 & 18)***	& Continuous Distributions Field Lines & Charge Motion	23.9	*Review*
5	23-Sep 25-Sep 27-Sep	24.1 – 24.2 24.3 24.4, 25.8	Electric Flux & Gauss Law Applications of Gauss Law **Quiz 4/** Conductors & Applications	23.23 23.37 24.4	E Field Mapping
6	30-Sep 2-Oct 4-Oct	25.1 – 25.3 25.4 25.5 – 25.6	Potential and Potential Difference E and V connections **Quiz 5/** Potential, Continuous	24.14 25.5 25.20	Resistance Heating
7	7-Oct 9-Oct 11-Oct	26.1 – 26.3 27.1 – 27.3 ***Exam2: In-class (Chap. 23 – 26)***	Capacitance, Capacitors, & Dielectrics Current, Resistance, and Conduction	No HW	*Review*
8	14-Oct 16-Oct 18-Oct	*Fall Break: No Classes*			
9	21-Oct 23-Oct 25-Oct	28.1 – 28.2 28.3 28.3	EMF and DC Circuits Kirchoff's Rules **Quiz 6/** Kirchoff's Rules	27.4 28.13	Simple & RC circuits
10	28-Oct 30-Oct 1-Nov	29.1 – 29.2 29.3 – 29.4 29.5 –29.6	Fields, Forces, and Particle Motion Applications and Current-carrying Wires **Quiz 7/** Torques on Current Loops	28.17 29.2	Magnetism
11	4-Nov 6-Nov 8-Nov	30.1 – 30.2 30.3 30.4 – 30.6	Biot-Savart Law & Magnetic Forces Ampere Law **Quiz 8/** Solenoids and Magnetism		Biot-Savart
12	11-Nov 13-Nov 15-Nov	31.1 – 31.2 31.3 – 31.4 32.4 – 32.5	Induction & Motional EMF Lenz Law & Induced EMF Inductance, RL, & LC Effects		EMI Investigation
13	18-Nov 20-Nov	34.1 – 34.3 34.6 – 34.7	EM Waves & Maxwell Equations Properties of EM Waves		

	22-Nov		***Exam3: In-class (Chap. 29 – 32)***		Review
14	25-Nov	35.1 – 35.4	Ray Approximation for Light Waves		
	27-Nov 29-Nov	*Thanksgiving Break: No Classes*			
15	2-Dec 4-Dec 6-Dec	35.5, 35.7-35.8 36.6-36.10	Analysis for Reflection & Refraction Image formation instruments **Quiz 10/** Duality of light nature		Optional
	11-Dec		***inal Exam: Cumulative, 8.30 – 11.30 am***		