Physics 152—Accelerated Physics II: Electricity, Magnetism, and Optics
Section 1, MWF 9:30 – 10:20 a.m.
Course Description, Fall 2024

Instructor:	Andrew Dougherty
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Web Page:	http://workbench.lafayette.edu/~doughera/
Course Web Page:	https://moodle.lafayette.edu/course/view.php?id=27800

Office Hours: I will have office hours at the times posted on my schedule below. You are not limited to the listed times. I will also normally be available on most other days during the free times indicated on my schedule. Please feel free to e-mail or call at any time and ask a question or set up an appointment.

Classes on Snow Days and Other Emergencies: If I am unable to make it to class, I will send out an email via Moodle.

Web Pages: All course assignments and documents will be posted to our Moodle site https://moodle.lafayette.edu/course/view.php?id=27800.

Description:

This course is an accelerated calculus-based introduction to the foundations of electricity, magnetism, and optics, designed primarily for science and engineering majors who already have some physics background. Topics will include electrostatics, electric currents, magnetostatics, induction, electromagnetic waves, ray optics, interference and diffraction.

Prerequisites: Phys 131 or Phys 151, and Math 162, or permission of instructor. More generally, the accelerated nature of this course depends on your background in both Physics and Mathematics. We will move quickly through those topics typically covered well in a high school physics course, but still allow ample time to cover the more complex and advanced topics carefully and in depth.

Texts: You will need two items for the lecture portion of this course: the textbook and the online "Mastering Physics" component. The textbook is *University Physics with Modern Physics, 15th edition* by Hugh D. Young and Roger A Freedman. The on-line component is *Mastering Physics*. An e-text version is included with your Mastering Physics subscription. If you would like a printed text as well, the textbook is the same one that has been used for the past several years at Lafayette in Phys 131/133/151/152, so used copies may be available. More details are available both on our Moodle site, and at http://workbench.lafayette.edu/~doughera/phys152/text.html.

The online platform contains both homework problems and a very rich set of study aids, including pre-lecture videos and and numerous fully-worked video tutor solutions.

Any additional resources needed will be linked from our Moodle site.

Lab Materials: There are no specific additional items needed for lab. The lab manual will be distributed digitally, and all lab reports will be submitted online.

Student Learning Outcomes: The main goal of this course is to help you understand, identify, and apply the fundamental principles of physics in a variety of situations. You should be able to use both qualitative reasoning and quantitative problem-solving skills in applying those principles. A second goal is to help introduce you to the *process* of doing physics, including skills such as developing and testing models, interpreting experimental data, solving problems, and communicating results.

Specifically, upon successful completion of this course, you should be able to

- Calculate the electric potential and field due to a variety of charge configurations,
- Calculate the magnetic field due to a variety of current configurations,
- Predict the motion of charges in a electric and magnetic fields,
- Build and analyze simple DC electrical circuits,
- Describe phenomena related to electromagnetic induction,
- Describe the characteristics of electromagnetic waves,
- Apply simple geometric optics, and
- Calculate the conditions for constructive or destructive interference of waves.

In addition to the outcomes listed above, this course (particularly the lab component) will promote the outcomes from the Natural Sciences section of the Common Course of Study:

- NS 1 Employ the fundamental elements of the scientific method in the physical and natural world by identifying and evaluating a testable scientific hypothesis.
- NS 2 Create and evaluate descriptions and representations of scientific data via equations, graphs, tables, and/or models.

Your Responsibilities:

Read the text. Your text is a critical resource for this class—it is a source of definitions, facts, ideas, explanations, derivations, and worked examples. I do not intend to spend class time simply repeating the text. Instead, class time will be used to *discuss* those ideas, answer your questions, observe demonstrations, do examples, and practice applying those ideas to various physical situations.

Accordingly, you should read the text ahead of time. I have included a detailed daily syllabus so you know what the assigned readings for each day will be.

The text also includes a large number of video resources, including pre-lecture videos and numerous fully-worked out problems. Some of these may be explicitly assigned throughout the course, but you are encouraged to review the offerings with each chapter and make good use of these resources. See the `Study Area` link at our Mastering Physics course site.

Ask questions. If you are confused, it is important that you stop me and try to sort it out rather than falling behind. *Please* interrupt and stop the class whenever anything isn't clear. Remember that if you are confused, there are almost certainly many others who are confused as well, and they would welcome your question.

Do all assigned work. A good rule of thumb is that you should anticipate spending approximately two hours outside of class for each hour in class for a college course. This means you should anticipate spending an average of six hours per week outside of class for physics (not including the lab). Plan ahead. I am here to help. If you start on your homework ahead of time, I will be available to help you if you get stuck. Don't wait until the night before an assignment is due before starting it.

Participate in class. Class time will be used to go beyond merely reading the text. Your active engagement during class can play an important part in helping you to master the material. Class time will also be used to announce changes to the syllabus. I will also post everything to our Moodle site. It is *your* responsibility to keep up.

Grades: Your grade will be based on homework (20%), laboratory (20%), tests (40% total) and final exam (20%). The lowest test or final exam score will only count as half of the usual total. If the lowest score is one of the three tests, than that test will only count for 8% of the total, and the two remaining tests will each count for 16% of the total (for a total of 40% for the tests.) If the final exam is the lowest score, it will only count for 10%, and the test average will count for 50%. The lowest homework assignment will also be dropped. Feel free to ask questions about how your grade is determined.

Tests: There will be three hour-long in-class tests on the dates indicated on the syllabus. There may also be additional quizzes, either announced or unannounced.

Equation Sheet: You will receive an equation sheet with each test. The idea is that you will use your study time to focus on the fundamental ideas and practice doing physics rather than to memorize formulae. A copy of this equation sheet is available on our Moodle site.

Laboratory: The laboratory is an essential part of this class, and successful completion of the laboratory is required in order to pass the course. You are responsible for completing all of the assigned experiments at the scheduled times. If you can not make it to your scheduled lab, please contact your lab instructor as soon as possible.

Final Exam: There will be a comprehensive final exam at a time to be arranged by the registrar. *Please do not make travel plans that conflict with the scheduled exam time.*

Homework: Assignments will be given regularly and will ordinarily be due at the beginning of class on the dates indicated on the syllabus.

- Some assignments will be given and graded using *Mastering Physics*, an on-line system with quick feedback, hints, and guided tutorials. Other assignments will be pencil-and-paper problems; these problems will typically focus as much on the *methods* of solving problems as on getting the right numerical answer.

- You are encouraged to work together on homework assignments, but collaborations must be acknowledged and should not be one-way only. You must fully understand whatever work you turn in. See the section on Academic Honesty below for more details.

- Problems will be due at the *beginning* of class. **Late homework will normally not be accepted**.

- For written homework, I expect your work to be clearly organized and easy to follow. You should include not just numbers and calculations, but also include some text to explain *what* you are doing and *why.* This can often be quite brief, but it is *your* responsibility to make your reasoning clear; it is not the reader's responsibility to try to figure out what you meant. Homework that is incomplete or difficult to understand will not get full credit. The following guidelines are intended to help *you* present your work effectively:

1. Be sure to include your name on each page.
2. Each problem should be clearly labeled.
3. It is often helpful to include figures. Any figures should have clear labels.
4. Show your work clearly, and include all non-trivial steps. Use words to explain what you are doing and why. This can often be very brief, something like "Use conservation of energy."
5. Allow plenty of space.
6. Put a box around your final solution, including correct units.

- **Illegible papers will not be accepted**. If I have difficulty reading or understanding your work, I may return it to you ungraded for re-submission. You may resubmit a legible version (along with the original) by the next class meeting, but that version must not have any new content—it must simply be a legible version of the original.

- Please look at the homework problems ahead of time and ask questions about them either in or out of class. I am happy to give whatever help you need, but it is important that you eventually learn to do these problems on your own—after all, that's what you will have to do on the tests.

- *Seminars:* Occasionally throughout the semester I hope to allow students to receive extra credit towards your homework score by attending physics department seminars (or seminars in related areas). These will be announced in advance.

Academic Honesty: The fabric of science, and indeed any intellectual endeavor, is built on the integrity of all involved. Accordingly, I take academic honesty very seriously. I expect that you will abide by the "Principles of Intellectual Honesty" appearing in the Lafayette College Student Handbook.

Working with others is often a helpful way to learn physics. For this course–and indeed for most advanced courses in any discipline—I believe such collaboration to be an essential element for success. I encourage you to collaborate with each other, but unless specifically directed otherwise, all work you turn in *as* your own should *be* your own. My expectation is that everyone will be open to both giving and receiving aid from their peers.

Some students also find it useful to consult other texts, friends, and even a variety of on-line sources. In all cases, though the principles of academic honesty apply: All nontrivial collaborators and external sources must be acknowledged (apart from your textbook and instructor). You may seek help understanding a problem, but all work you turn in must be your own original work. Copying an answer from another source, such as CourseHero, Chegg, Bartleby, or a generative AI source, is a violation of the Academic Honesty Policy. Although some students believe that looking up solutions as soon as they get stuck helps their learning because they get immediate feedback, I would argue that the negatives of this approach outweigh any benefits.[1] In particular, merely looking up a solution:

- Creates a false sense of security that won't be there during exams.

- Can replace other healthy learning behaviors, such as: reading through the text for missing concepts or similar examples; asking a friend; asking a professor; taking a break and coming back to the question later; having a "Eureka" moment when out for a walk. These are all healthy learning behaviors, and doing less of them is a negative.

[1] This discussion is based on one in Prof. Boekelheide's syllabus.

- Often fails to lead to actual learning. It won't necessarily help you the next time you encounter a somewhat similar situation. Students who take the "easy" way out and get excessive or inappropriate help from others tend to get significantly lower grades on the tests. Learning to do problems by yourself is the best preparation for the tests.
- Can lead to a culture where it feels like everyone knows the answer all the time and being unsure of a solution feels abnormal. This is exactly backwards. Being unsure of a solution is normal.

Please read the department's Academic Honesty policy for the rules regarding collaboration. Feel free to ask if you have any questions about this policy.

Attendance: You are expected to complete all assigned work in a timely fashion, but I do not take daily attendance. I appreciate notice if you are unable to attend class, but a Dean's excuse is only required if you miss a graded assignment.

Inclusivity: All students should feel welcome in Physics class. We all bring our own unique perspective to class, and it is my intention that all students feel included in the intellectual community of the classroom. Unfortunately, the history of science is full of exclusion, so it's important to be explicit about inclusion.

Please contact me if you feel your identity is not being honored in class, if you have a preferred name or pronouns that I am not aware of, you observe religious holidays which conflict with coursework, or if there is something else that I should address. I am still learning, too, and your feedback is important to me.

Generative AI Statement: See the general Academic Honesty section above.

Proper Usage of Course Materials: All course materials are proprietary and for class purposes only. This includes posted recordings of lectures, examples, tests, solutions, and other course items. Such materials should not be reposted. Online discussions should also remain private and not be shared outside of the course. You must request my permission prior to creating your own recordings of class materials, and any recordings are not to be shared or posted online even when permission is granted to record. If you have any questions about proper usage of course materials feel free to ask me.

Class Recordings: From time to time, it will be useful to record our classes for those unable to attend in person. I will make any such recordings available on a Google Drive shared within the class.

These recordings are for the use of this class only, and should not be shared outside of the class. If you have any concerns with being recorded during the course please let me know.

Federal Credit Hour Statement: The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar's Office web site
https://registrar.lafayette.edu/wp-content/uploads/sites/193/2013/04/Federal-Credit-Hour-Policy-Web-Statement.doc for the full policy and practice statement.

Andrew Dougherty Fall 2024
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Time	**Mon.**	**Tues.**	**Wed.**	**Thurs.**	**Fri.**
9:30	**Phys 152**		**Phys 152**		**Phys 152**
10:20	HSC 142		HSC 142		HSC 142
10:35					
10:45					
11:00		**Phys 338**			
11:25		HSC 042			
11:40	**Phys 335**		**Phys 335**		**Phys 335**
12:15	HSC 017		HSC 017		HSC 017
12:30					
12:55					
1:15					
1:40		**Phys 152**			
2:30		**Lab**			
2:45		HSC 119			
3:35					
4:00					
4:10					
4:30					
5:00		Committee	*Physics Club*		
5:30		Meeting			

ACADEMIC HONESTY GUIDELINES
Department of Physics

It is expected that each student taking courses in the Department of Physics is familiar with the statement "Principles of Intellectual Honesty" appearing in the Lafayette College Student Handbook. The following guidelines are intended to indicate how that statement pertains to your work in physics. Your instructor may have further guidelines for your specific course. We assume that students are honest; if you are not certain as to what is expected of you, consult your instructor before proceeding.

I. EXAMINATIONS:

1. Bring only those materials specifically authorized by your instructor. Frequently in the elementary courses, you will be permitted to bring in a formula sheet or you will be provided with one.

2. If you find that the seating arrangement is such that you can see someone else's paper, don't look! Better yet, ask if you can sit in another seat.

3. If you use a calculator, clear the answer before setting the calculator aside.

4. If you fail to hand in your paper at the end of the period you will be awarded a grade of zero for that test.

II. TAKE-HOME EXAMINATIONS: Take-home examinations are often assigned in some courses. Specific rules governing such tests will be announced by your instructor. The overriding principle, however, is that any work submitted be your own or be specifically credited to its source. There should be no discussion of the test questions with *anyone* other than the instructor.

III. HOMEWORK: You must acknowledge *all* collaborators. You are encouraged to learn from one another. You should first try to do homework problems on your own; after all you will have to do similar problems on your own in tests. However, discussion of difficult problems with others can help you to develop your own analytical skills and is encouraged, provided that, *after discussion* you write up solutions *on your own.* Do *not* borrow or lend homework papers. There is an important difference between discussing a problem with someone and copying his or her work. There have been students who have loaned papers to friends for a few minutes to "check answers", and been horrified to find themselves charged with academic dishonesty because their "friends" copied their solutions.

Please Note: The same ethical standards of academic integrity and honesty apply to the on-line homework as to the written homework, except that there is no place for you to specifically acknowledge collaboration. However, the same general rules apply.

IV. LABORATORY: Usually two or more students will work together in performing experiments and will submit reports of their work. In some courses, a single joint report may be submitted. Specific instructions will be announced by your instructor. If the words used to describe some part of the experiment are taken from some other source (such as the lab manual), then the source should be cited. (Reference to the lab manual can usually substitute for laborious copying.) If you consult with *anyone* about the experiment (e.g. students in your lab class other than your lab partner), that consultation should be acknowledged in your report. Do *not* borrow or lend a completed lab book or any portion of one.

V. PAPERS: Refer to the statement "Principles of Intellectual Honesty" in the Student Handbook.

Syllabus		Phys 152	Fall 2024
Aug.	26	Introduction; Coulomb's Law; Electric Fields	Ch. 21:1–4
	28	Electric Fields of Charge Distributions	Ch. 21:5
	30	Electric Field Lines; Dipoles; HW #1	Ch. 21:6–7
Sept.	2	Electric Flux; Gauss's Law	Ch. 22:1–3
	4	Applications of Gauss' Law	Ch. 22:4
	6	Conductors	Ch. 22:5
	9	Electric Potential and Potential Energy	Ch. 23:1
	11	Electric Potential; HW #2	Ch. 23:2
	13	Calculating Electric Potential	Ch. 23:3
	16	Equipotential Surfaces; Potential Gradient	Ch. 23:4–5
	18	Capacitance; Electric Field Energy; HW #3	Ch. 24:1–3
	20	**Exam I**	
	23	Current and Resistance; Ohm's Law	Ch. 25:1–3
	25	Energy and Power in Circuits	Ch. 25:4–5
	27	Kirchhoff's Rules; DC Circuit Applications; HW #4	Ch. 26:1–2
	30	RC Circuits	Ch. 26:4
Oct.	2	Magnetic Fields	Ch. 27:1–3
	4	Magnetic Forces on Charged Particles; HW #5	Ch. 27:4–5
	7	Magnetic Forces on Current-carrying wires	Ch. 27:6–7
	9	Biot-Savart Law	Ch. 28:1–4
	11	Ampère's Law; HW #6	Ch. 28:5–6
	14	*Fall Break*	
	16	Applications of Ampère's Law	Ch. 28:7
	18	**Exam II**	
	21	Faraday's Law and Lenz's Law	Ch. 29:1–3
	23	Faraday's Law Applications	Ch. 29:4–6
	25	Induction and Maxwell's Equations; HW #7	Ch. 29:5–7
	28	Induction and Magnetic Field Energy	Ch. 30:1–3
	30	RL, LC, and RLC Circuits	Ch. 30:4–6
Nov.	1	Mechanical Waves Review; HW #8	Ch. 15:1–5
	4	Superposition and Interference	Ch. 15:6–8; Ch. 16:6
	6	Electromagnetic Waves	Ch. 32:1–3
	8	Energy and Intensity; Standing Waves; HW #9	Ch. 32:4–5
	11	Reflection and Refraction	Ch. 33:1–3
	13	Polarization and Scattering	Ch. 33:4–6
	15	**Exam III**	
	18	Geometric Optics	Ch. 34:1,4
	20	Thin Lenses	Ch. 34.5–8
	22	Interference; HW #10	Ch. 35:1–3
	25	Diffraction	Ch. 36:1–3
	27–29	*Thanksgiving*	
Dec.	2	Multiple Slits; Diffraction Gratings	Ch. 36:4–5
	4	Thin Film Interference	Ch. 35:4
	6	Final Review; HW #11	
		Final Exam (cumulative)	

Revised September 11, 2024