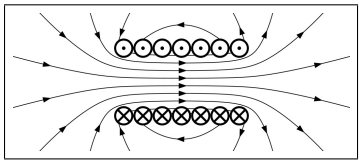

Physics 152:
Accelerated Physics II:
Electricity, Magnetism, and Optics
Lafayette College
Fall 2017

What This Course Is About

The catalog says: "An accelerated calculus-based introduction to the study of physics for science and engineering majors; a foundation on which an understanding of physics, physical chemistry, or engineering can be built. Topics include electrostatics, electric currents, magnetostatics, induction, electromagnetic waves, ray optics, interference, and diffraction."

At first glance, this course appears to encompass a wide range of unrelated phenomena. However, we will see that these things all arise from a small number of fundamental ideas, and these ideas can be incorporated into a small number of equations. This simplicity—the beauty of being able to understand many things with a few simple ideas—is what I love about physics.

There are two reasons that electromagnetism is studied at this point in the physics curriculum:

- Electromagnetism is one of the *four fundamental forces of nature* (along with gravitation, the weak force, and the strong force). Thus it is of intrinsic interest. Further, electromagnetism and gravity are the only two of these forces which have effects which you can see with your own eyes. This makes them the natural subjects of any introductory physics sequence.
- Electromagnetism is all about *fields*. The mathematical and physical techniques used to study electromagnetism can be extended to analyze all other physical forces. It is no exaggeration to say that fields underlie nearly all modern work in fundamental physics.

Instructor

Prof. David Nice
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Homepage: http://sites.lafayette.edu/niced

The instructor for Physics 152 labs is Prof. Andy Dougherty, Hugel 028, doughera@lafayette.edu.

Course Website

We will use Moodle, http://my.lafayette.edu or http://moodle.lafayette.edu.

Course Locations and Times

Class. Hugel Science Center 142. Monday, Wednesday, Friday; 9:00-9:50.
Lab. Hugel Science Center 142. Tuesday, 1:10-4:00.

Office hours

I will have weekly office hours:

- Monday 10:00-11:00
- Tuesday 3:00-5:00 (ends at 4:00 Aug 28, Oct 3, Nov 7, Dec 5)
- Wednesday 10:00-11:30 and 2:00-3:00
- Friday 10:00-11:00

There is a small chance these will need to be changed once the semester begins. I will keep an up-to-date list of office hours on moodle and on my personal website.

Office hours are a great time to stop by for questions about course material, homework problems, or anything else related to the class. If you wish to meet, but have conflicts with my scheduled office hours, E-mail me to schedule an appointment, or just stop by and try your luck.

Texts and other references

The following text is required and is available at the college bookstore:

- H. D. Young and R. A. Freedman. *University Physics with Modern Physics.* 14th edition. Pearson. ISBN 978-0321973610. This is the same text used in Physics 151 and in the Physics 131-132-133 sequence. We will not use MasteringPhysics (which is used in 131-132-133 but not 151-152).

The following books may be useful references if you want different perspectives on the course material. The books by Schey, Purcell, and Moore will be available at the reserve desk of Skillman library. The book by Stewart is ubiquitous at Lafayette. (If you don't have a copy yourself, your roommate probably does.)

- H. M. Schey, *Div, Grad, Curl, and All That.*
- E. M. Purcell & D. J. Morin, *Electricity and Magnetism,* 3$^{\text{rd}}$ edition.
- T. A. Moore, *Six Ideas that Shaped Physics, Unit E.*
- J. Stewart, *Calculus*, chapter on vector calculus (6$^{\text{th}}$ ed.: chap. 17; 7$^{\text{th}}$ ed.: chap. 16).

Prerequisites

The prerequisites for this course are (i) Physics 131 or 151 and (ii) Math 162. Talk to the instructor if you believe this class is appropriate for you but do not have these prerequisites.

Homework

There will be weekly homework assignments. Homework papers will be due on Wednesday at 5 p.m. in a bin in the hallway near my office door. Late homework papers will be accepted for 50% credit through Friday at 5 p.m.

If you cannot complete a homework due to illness, family emergency, or similarly compelling reason, please contact me. (Also see the section on "Dean's excuse policy" in the Student Handbook.)

I *strongly* encourage you to work with other students on the homework. Try the problems yourself. When you get stuck, talk to someone else about them. Physics is hard. You won't get all the problems on your own. Working with others is absolutely essential in advanced physics classes.

I will have extensive office hours. They are purposely scheduled on days before homework is due. Please come and visit if you are having difficulty on homework. I am happy to help.

Labs

Labs will meet weekly starting with the second week of classes. You will need a lab notebook, which you and your lab partner will share. The lab manual will be available at the bookstore soon.

Exams

There will be two midterm exams. They are scheduled for Friday, October 6 (the day before fall break) and Monday, November 20, the week of Thanksgiving break. You will have one hour and fifty minutes for each of these exams, including 60 minutes before or after the regular class time on that day. (If you have schedule conflicts before and after class time, we will find an alternate time later that day.)

There will be a three hour final exam at a time set by the registrar.

Exams will be closed book with equation sheets provided. I will make copies of the equation sheets available in advance of each exam. I will post exams from a previous year on Moodle.

Exam questions will resemble homework problems. Each midterm exam will be on the material covered in the preceding weeks of class (i.e., since the previous midterm exam). The final exam will cover all course material, with a slight bias towards material covered after midterm #2.

Grading

There must be grades. Your grade will be based on:

Lab	10%
Homework	20%
Midterm Exam #1	20%
Midterm Exam #2	20%
Final Exam	30%

I will post homework and exam grades on moodle. Exam grades may be re-scaled depending on the difficulty of the exam. I will use the following numerical score when setting letter grades:

A	92.500 and higher	C	72.500−76.499
A−	89.500−92.499	C−	69.500−72.499
B+	86.500−89.499	D+	66.500−69.499
B	82.500−86.499	D	62.500−66.499
B−	79.500−82.499	D−	59.500−62.499
C+	76.500−79.499	F	59.499 and below

This is not Physics 151

Physics 151 and Physics 152 are designed to provide a comprehensive introduction to classical physics. However, the two courses are taught by two different instructors whose policies and styles may differ. Please do not assume a policy applies in Physics 152 because "that is how we did it in Physics 151." When in doubt, ask.

What to call me

Please, let's all use first names. Call me David.

Whom we root for (besides Lafayette, of course)

We root for the Philadelphia Eagles. In emergency situations, when the Philadelphia Eagles are not available to be rooted for, we root for the Green Bay Packers.

Course goals and topic coverage

The goal of Physics 152 is to give you an understanding of the fundamental ideas which arise from the theory of classical electromagnetism, particularly those topics listed below.

The schedule will evolve as the semester progresses. Specific topic and text coverage will be given on the weekly homework assignments.

We will introduce certain mathematics techniques that extend beyond those used in the textbook. The use of these techniques simplifies calculations and increases understanding of physics concepts. Specifically, we will introduce three-dimensional vector operations—divergence, gradient, and curl—to aid in analyzing and picturing electric and magnetic fields. We will introduce complex number representations of oscillating functions for the analysis of alternating current circuits.

Topic	Text Chapters*	Approximate number of classes
Electric force and field	YF21	3
Flux; Gauss's law; Divergence	YF22	4
Electric potential; Gradient; Laplacian	YF23	4
Capacitance; Dielectrics	YF24	2
Current; Resistance	YF25	2
DC circuits	YF26	2
Magnetic force	YF27	2
Magnetic fields	YF28	3
Curl; Induction	YF29	3
Induced fields and currents	YF30	2
AC circuits	YF31	3
Properties of Waves	YF33†	1
Geometric optics	YF34†	2
Maxwell's Equations; Electromagnetic Waves	YF32†	3
Interference; Diffraction	YF35	3
Limits of Classical Physics		1

*YF=Young & Freedman, *University Physics*
†Chapters covered out of sequence

Outcomes

After completing this course, you will be able to....

- Analyze the behavior of particles in response to electric and magnetic fields.
- Understand the connection between potentials, fields, and sources.
- Use divergence, gradient, and curl operations.
- Understand the interrelation of electric and magnetic fields through Maxwell's equations.
- Construct and analyze AC and DC circuits.
- Analyze optical systems with one or more lenses.
- Analyze the behavior of systems exhibiting interference.

Within the Lafayette Common Course of Study, this course (particularly the lab component) will promote the following outcomes for Natural Sciences:

- NS1. Employ the fundamental elements of the scientific method in the physical and natural world.
  - NS1a. Identify and/or formulate a testable scientific hypothesis.
  - NS1b. Generate and evaluate evidence necessary to test and/or revise a hypothesis.
- NS2. Create, interpret, and evaluate descriptions and representations of scientific data including graphs, tables, and/or models.
- NS3. Understand how scientific uncertainty informs the evaluation of hypotheses.

Intellectual honesty

You are expected to abide by the principles of intellectual honesty outlined in the Lafayette Student Handbook (available from http://conduct.lafayette.edu).

Learning is a collaborative process. Discussion and collaboration on homework in this course is very strongly encouraged. "Collaboration" does not mean "copying." You must understand and individually write out your answer to each problem.

Exams must be done on your own, using only materials specifically allowed. Exam procedures will be discussed in detail before each exam.

Accommodation

My policy. It is important to me that you do well in this class. If you have any disabilities which you feel may interfere with your ability to succeed and prosper in this class, please contact me to discuss ways of accommodating them.

Mandatory statement for any Lafayette course with a disability policy. In compliance with Lafayette College policy and equal access laws, I am available to discuss appropriate academic accommodations that you may require as a student with a disability. Requests for academic accommodations need to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students must register with the Office of the Dean of the College for disability verification and for determination of reasonable academic accommodations.

Mandatory Moodle privacy statement

Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA). Disclosure to unauthorized parties violates federal privacy laws. Courses using Moodle will make student information visible to other students in this class. Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class. Questions can be referred to the Registrar's Office.

Mandatory credit hour statement

The student work in this course is in full compliance with the federal definition of a four credit hour course.