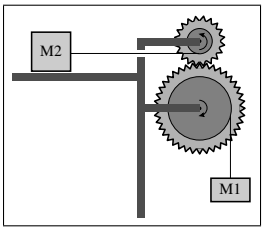
Physics 151
Accelerated Physics I: Mechanics and Thermodynamics
Lafayette College
Spring 2021



Course operations

Instructor

Prof. David Nice
Hugel Science Center 030
niced@lafayette.edu
`http://sites.lafayette.edu/niced`

Locations and Times

Class: Hugel Science Center 100
Monday, Wednesday, Friday; 10:00-10:50

Lab*: Remote via Zoom
Tuesday 1:10-4:00
*A few students are in other lab sections

This course is planned to be in-person as much as possible, but it may be necessary to teach some class sessions remotely due to Covid-19 precautions, bad weather, or other issues. I will send E-mail should we need to meet remotely. Please monitor your E-mail regularly throughout the semester.

Zoom

Due to the Covid-19 pandemic, lab sessions and office hours will be conducted remotely via Zoom. If in-person teaching is interrupted, class will be conducted remotely via Zoom. We will use the same Zoom link for all Physics 151 activity: `https://lafayette.zoom.us/j/94003070268`

Quarantine/Isolation

Should you be in quarantine or isolation at any point during the semester, please contact me as soon as possible. We will work out accommodations on a case-by-case basis. We will have the capability of streaming and/or recording class sessions should it become necessary.

Website

Handouts, homework assignments, etc., will be distributed on paper and posted on Moodle.

Office hours

Office hours are a great time to discuss questions about course material, homework problems, or anything else related to the class.

I will have weekly office hours:

- Wednesday 11:00 to 11:30 and 1:30 to 2:30
- Thursday 2:00 to 3:00
- Friday 11:00 to 11:30 and 1:30 to 2:30

These times will be listed on Moodle and may change as the semester evolves. I am often available to meet at other times, so feel free to E-mail any time you would like to talk.

Office hours will be held via Zoom. Since I won't always have Zoom on running during office hours, send me an E-mail if you'd like to talk, after which we can connect on Zoom. Office hours meetings immediately after class might also be done in-person in my office or in a classroom.

Text

We will use the following text:

- Young and Freedman, *University Physics with Modern Physics and MasteringPhysics* 14^{th} edition. ISBN 978-0-13-409650-6 (for print+online combination, but see below).

We will use the "Modified Mastering Physics" online system for about half of the homework. This comes bundled with the textbook, or you can buy access separately.

You need to have access to the textbook itself, but how you access it is up to you. You can use a printed copy (used or new), an eText (which an be obtained along with access to mastering physics), or maybe you can find a .pdf of the text somewhere. Whatever works best for you is fine. The printed version is fine if you like that, but electronic is also fine if that is your preference.

Make sure you get fourteenth edition. (There is a 15th edition out, but we are sticking with the previous 14th edition for with the hope that old copies will be readily available for you.)

While the text is an important resource, classes and homework sets will be your primary guide to what you need to know to succeed in this course. Skim through the assigned sections of the text, but read through the examples carefully. Use the text as a reference as you work homework problems and study for exams.

Homework

There will be weekly homework assignments. They are the heart of this course. You don't learn physics by reading about it, or by hearing lectures about it, or by watching someone else do it. You learn it by doing it yourself: doing real experiments in lab and doing real calculations in homework.

Homework will be a combination of on-line and traditional paper homework. The on-line portion will use MasteringPhysics, `http://masteringphysics.com`. The course ID is `nice85832`.

Paper homework should be scanned or photographed and submitted on Moodle. Additional information on homework logistics and grading will be given on the first homework assignment.

Homework will be due Fridays at 5 pm. Late papers will be accepted through the following Monday. Scores for late Mastering Physics problems will be reduced in proportion to how late the work was submitted up to a maximum of 72 hours. Late paper homework may be penalized by 50%. If you are having difficulty completing an assignment on time, please contact me.

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 in groups is a powerful way to learn. It is also more fun.

Please take advantage of office hours if you have questions about the homework. I am happy to help. Often there will be other students there with questions similar to yours. I expect that most of you will take advantage of office hours sooner or later during the semester.

Labs

Labs are an essential part of the course. Due to the Covid pandemic, labs will be remote this semester. Most weeks, you will use interactive videos to make measurements which you will then analyze. You will work in groups of two. Lab procedures will be distributed via Email and posted on the lab Moodle site. Lab operations will be discussed in detail at the first lab meeting.

Exams

There will be three midterm exams:

- Midterm exam #1. Monday, March 8. In class.
- Midterm exam #2. Tuesday, April 6. In lab.
- Midterm exam #3. Tuesday, May 4. In lab.

Exams #2 and #3 will be given in lab period. This allows the exams to be more than 50 minutes long, which helps lower time pressure. Students who have conflicts with the lab period will be accommodated, with details to be worked out a few days before each exam.

Each midterm exam will be on the material covered in the preceding weeks of class (i.e., since the previous hour exam). Further details will be given before each exam.

There will be a comprehensive final exam during finals week covering all material in the course. The final exam will be three hours and will be scheduled by the registrar.

All exams will be closed book, with equation sheets provided. Copies of the equation sheets will be available in advance. Exam questions will resemble homework problems.

Grading

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

Homework	20%
Lab	15%
Midterm Exam #1	10%
Midterm Exam #2	15%
Midterm Exam #3	15%
Final Exam	25%

I will post homework and exam grades on Moodle. The 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	B−	79.500−82.499	D+	66.500−69.499
A−	89.500−92.499	C+	76.500−79.499	D	62.500−66.499
B+	86.500−89.499	C	72.500−76.499	D−	59.500−62.499
B	82.500−86.499	C−	69.500−72.499	F	59.499 and below

Memorization

Knowledge of terminology and notation is an important part of a scientific education. For this course, you are required to memorize the metric prefixes listed below and to know how to use them. They will be tested on midterm exam #1 and may be used in subsequent exams.

Prefix	Abbreviation	Multiplier
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}

Prefix	Abbreviation	Multiplier
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}

The computer industry uses prefixes to represent multiples of 1024 (e.g., 1 kbyte = 1024 bytes), but in physics they always are factors of 1000 (1 km = 1000 m).

Course Description

Overview

From the college catalog: An accelerated calculus-based introduction to the foundations of classical mechanics and thermodynamics, intended for students majoring in science or engineering; a foundation on which an understanding of physics, physical chemistry, or engineering can be built. Topics include dynamics; conservation laws for linear momentum, angular momentum, and energy; mechanical oscillations and waves; and thermodynamics.

Lafayette calculus-based introductory mechanics/electromagnetism courses. We have two such course sequences, Physics 131/133 and Physics 151/152. Physics 151/152 is designed for students with significant prior experience in physics and/or strong interest in the field. Physics 151/152 proceeds more rapidly than Physics 131/133, especially in the first weeks of the semester. This allows Physics 151/152 to cover material with greater depth and breadth than Physics 131/133. Both course sequences use the same textbook, and students may switch between the sequences midway through the sequence (i.e., take Physics 131 and then 152, or take 133 and then 151).

Math prerequisite

Math 161 (Calculus I) is a prerequisite of Physics 151. You should understand the fundamental ideas of calculus, and you should have a working knowledge of derivatives and integrals of polynomials, basic trigonometric functions, exponents, and logarithms.

Course goals and topic coverage

The goals of this course are to teach you to *think like a physicist* and to provide a foundation for further study in physical science and engineering. We will accomplish this by introducing you to the following topics. This list may evolve as the semester progresses. Specific topic and text coverage will be given on a weekly basis on the homework assignments.

Topic	Text Chapters	Approximate number of class sessions
Units	1	1
Kinematics in one or more dimensions	2,3	4
Newton's laws and applications	4,5,13	4
Conservation of energy and momentum	6,7,8	8
Rotational motion	9,10	9
Oscillations	14	3
Waves	15,16	5
Thermodynamics	17,18,19,20	7

Outcomes

After completing this course, you will be able to understand, identify, and apply the fundamental principles of physics in a variety of physical situations. You will be able to use both qualitative reasoning and quantitative problem-solving skills in applying those principles. Among other things, you will be able to:

- Model static and dynamic physical situations using qualitative and quantitative models.
- Use and manipulate vector equations for solving physical problems.
- Use conservation laws for scalar and vector quantities.

- Use calculus concepts in analyzing physical situations.
- Analyze oscillatory and wave motion.
- Apply the laws of classical thermodynamics.

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 by identifying and evaluating a testable scientific hypothesis.
- NS2. Create and evaluate descriptions and representations of scientific data via equations, graphs, tables, and/or models.

Course policies

Intellectual honesty

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

Learning is a collaborative process, I encourage you to discuss and collaborate with other students on homework. "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.

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.