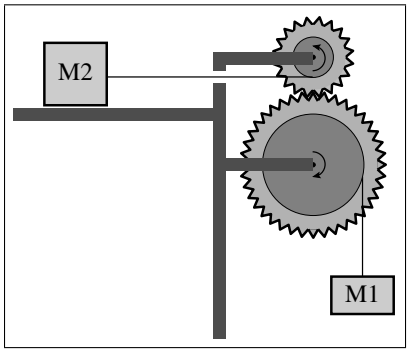
Physics 131: Mechanics
Lafayette College
Spring 2017
Section 4 (MWF 1:10 pm)



Instructor

Prof. David Nice
Office: Hugel Science Center 030
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Phone: x5204
Homepage: http://sites.lafayette.edu/niced

Website

We will use moodle, `http://my.lafayette.edu` or `http://moodle.lafayette.edu`. Handouts, homework assignments, etc., will be distributed on paper and posted on moodle.

Locations and Times

Class: Hugel Science Center 100
Monday, Wednesday, Friday; 1:10-2:00

Lab: Hugel Science Center 123
There are many lab meeting times. Due to space limitations in the lab room, the Registrar may have placed you in a lab section other than the on you requested. For scheduling issues, contact the lab coordinator, Scott Shelley, shelleys@lafayette.edu, Hugel 015.

Office hours

I will have weekly office hours in Hugel 030:

- Monday 3:00-4:00
- Tuesday 11:00-12:00 & 2:00-3:00
- Wednesday 2:00-3:00
- Friday 2:00-3:00

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.

Supplemental Instruction

We will have student-led supplemental instruction (SI) sessions and office hours. Details will be annouced in class.

Overview

From the college catalog: This course is a calculus-based introduction to the foundations of classical mechanics, designed primarily for students majoring in science and engineering. The course will cover kinematics and dynamics with an emphasis on identifying, understanding, and applying fundamental principles, especially conservation laws for energy, linear momentum, and angular momentum.

Math prerequisite

Math 161 (Calculus I) is a prerequisite of Physics 131. 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.

Other introductory physics courses

Everyone is welcome in Physics 131. However, you should be aware of two other introductory physics sequences. Students with strong interest in physics and/or strong previous background in physics (for example, non-calculus AP physics courses) should consider Physics 151, which covers material at more depth than Physics 131. Pre-med, pre-dental, and pre-vet students may wish to consider Physics 111 and 112, which cover more topics with less depth than sequences that begin with Physics 131. Students who are not majoring in science or engineering may wish to consider Physics 104, 106, or 108, which have less of a technical focus.

Other sections of Physics 131

There are four sections of Physics 131 taught this semester, taught by three different professors. Topic coverage will be similar, and all sections will have the same homework sets. The exams will be different, and course policies and teaching styles may vary between sections. Those of us teaching the course will work hard to ensure that grading and workload are equitable across all three sections.

If you need to switch lecture sections, you should do so as soon as possible. See one of the Physics 131 instructors. A drop/add form must be filed. Changes can only be made for compelling reasons (e.g., a conflict with another class or other college activity). If you need to switch lab sections, contact lab coordinator Scott Shelley.

Labs

Lab is an essential part of the course. You will work on a variety of experiments which are closely correlated with the material we cover in class. Your lab section will meet beginning this week. You will work with a partner. You will need a copy of the lab manual, available at the bookstore. You and your partner will need a lab notebook—it should have a sewn binding (not spiral) with quadrille rule (graph paper). The bookstore should have some in stock; they have black covers and the bookstore usually calls them "physics notebooks."

Text

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

- Young and Freedman, "University Physics with Modern Physics MasteringPhysics," 14^{th} edition. ISBN 9780321982582.

Make sure you get fourteenth edition. In Physics 131, we will primarily use chapters 1-10 and 13-16. Physics 133 uses other chapters of this same text. Physics 151 and 152 also use this text.

You need to have "MasteringPhysics." This comes bundled with the text, and it gives you an access code for www.masteringphysics.com, which we use for some homework assignments. If you buy a used text, and it doesn't come bundled with MasteringPhysics, you will need to purchase access separately.

While the text will serve as an important resource, classes and, especially, the homework sets will be your primary guide to what you need to know in order to do well 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.

Except for homework #1 (due the first Friday of the semester), homework papers will be due on Wednesday at 4:00 pm in a bin in the hallway near my office door. Late papers will be accepted for 50% credit from Wednesday 4:00 pm through Friday 4:00 pm.

Portions of the assignments will be done using the MasteringPhysics on-line system, under course id `LAFPHYS131SP2017`. On-line problems will be due at the same time as the paper assignments. Late on-line work will be accepted for up to 48 hours, with a sliding scale proportional to the time the paper is late (e.g., 12 hours late is 25% off).

If you cannot complete an assignment due to illness, family emergency, or similarly compelling reason, please contact me. (Also see the "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 in groups is a powerful way to learn. It is also more fun.

I will have extensive office hours. Please come and visit if you are having difficulty on 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.

Exams

There will be two in-class hour exams. They will be given on Fridays: February 24 and April 7. There will be a 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. Each hour exam will be on the material covered in the preceding weeks of class (i.e., since the previous hour exam).

Grading

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

Homework	15%
Lab	15%
Hour Exam #1	20%
Hour Exam #2	20%
Final Exam	30%

I will post homework and exam grades on moodle. Lab grades will be posted at the end of the semester. 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	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

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 hour exam #1 and may be used in subsequent exams.

Selected Metric prefixes

Prefix	Abbreviation	Multiplier	Prefix	Abbreviation	Multiplier
tera	T	10^{12}	centi	c	10^{-2}
giga	G	10^{9}	milli	m	10^{-3}
mega	M	10^{6}	micro	μ	10^{-6}
kilo	k	10^{3}	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 goals and topic coverage

The goal of this course is 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 a series of topics in kinematics and dynamics. A preliminary schedule of topics is given at the end of this syllabus.

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. Learning outcomes for the course include:

- You'll be able to understand and apply the fundamental principles of mechanics and especially

Newton's laws of motion in a variety of physical situations.

- You'll be able to identify conserved quantities in a physical system and apply the corresponding conservation laws in order to extract information about that system.
- You'll be able to describe natural phenomena using the language of mathematics including calculus concepts and vector quantities.
- You'll be able to apply both qualitative- and quantitative-reasoning skills toward solving concrete problems, but also to communicate the reasoning behind your solutions to others.
- You'll be able to perform experimental measurements relevant for testing a hypothesis and to evaluate whether your data supports, motivates the revision of, or refutes that hypothesis.
- You'll be able to interpret, create, and describe graphical representations of data.

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 in the "Policies and Resources" section of http://studentlife.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.

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.

What to call me

Please, let's all use first names when talking to each other. Call me David.

Welcome aboard

I love teaching introductory physics, and I am excited to be leading this class. I hope you are happy to be here. The material will be challenging, but it will be rewarding. Welcome aboard!

Preliminary schedule. Day-by-day topic coverage may change as the semester progresses.

Week Number	Date	Topic Topic	Text Chapter(s)	Homework Assignment	Lab (Mon-Thu)
1	23-Jan	Introduction	1		
	25-Jan	Units & velocity			Stats and Uncertainty
	27-Jan	Velocity vectors		1	
2	30-Jan	Velocity and acceleration	2		
	1-Feb	Constant acceleration (1D)		2	Free Fall
	3-Feb	Constant acceleration (2D)			
3	6-Feb	Acceleration in 2D	3,4		
	8-Feb	Acceleration about 2D cont.		3	Projectile Motion
	10-Feb	Newton's Laws			
4	13-Feb	Free-body diagrams	4,5		
	15-Feb	Friction		4	The Inclined Plane?
	17-Feb	Spring force			
5	20-Feb	Circular motion	3,5,13		
	22-Feb	Gravitational force and orbits		5	Spring Force?
	24-Feb	*Exam 1*			
6	27-Feb	Work and kinetic energy	6,7		
	1-Mar	Potential energy		6	Friction
	3-Mar	Energy problems			
7	6-Mar	Energy problems (cont)	7,13		
	8-Mar	Conservative forces & potential energy		7	Energy Cons./Spring
	10-Mar	Gravitational potential energy			
	13-Mar	*Spring break*			
	15-Mar	*Spring break*			
	17-Mar	*Spring break*			
8	20-Mar	Power	6,8		
	22-Mar	Momentum conservation		8	To be announced
	24-Mar	Collisions in 1D			
9	27-Mar	Collisions in 2D	8,9		
	29-Mar	Center of mass		9	1D collisions
	31-Mar	Introduction to rotation			
10	3-Apr	Rotational kinematics	9		
	5-Apr	Moment of inertia		10	Rotational Dynamics
	7-Apr	*Exam 2*			
11	10-Apr	Rotational kinetic energy	9,10		
	12-Apr	Torque		11	Rotational Energy
	14-Apr	Angular momentum			
12	17-Apr	Angular momentum vector	10,14		
	19-Apr	Simple harmonic motion		12	To be announced
	21-Apr	Simple harmonic motion			
13	24-Apr	Damped & driven harmonic motion	14,15		
	26-Apr	Wave properties		13	Pendulum
	28-Apr	Wave properties			
14	1-May	Wave power and intensity	15		
	3-May	Superposition and interference			Standing waves
	5-May	Standing waves & interferometry			