Physics 131: Mechanics
Lafayette College
Spring 2014

Instructor

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Course Website

We will use moodle, http://moodle.lafayette.edu. Course handouts, homework assignments, etc., will be distributed in paper form in class and will also be available on the moodle site.

Course Locations and Times

Class: Hugel Science Center 100
   Monday, Wednesday, Friday; 1:10-2:00
Lab: Hugel Science Center 123
   There are ten Physics 131 lab sections this semester. Due to space limitations in the Physics 131 lab room, the registrar may have placed you in a lab section other than the one you requested. If you have scheduling issues, please see the lab coordinator, Scott Shelley, Hugel Science Center 015.

Labs will meet this week for orientation purposes. You don’t need a lab notebook this week.

Office hours

I will have weekly office hours:
   • Monday 3:00-4:30
   • Tuesday 11:30-12:30 & 3:00-4:00
   • Wednesday 3:00-4:30
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.

What to call me

Please, let’s all use first names. Call me David.
Course overview

The college catalog says it well:

A rigorous 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. Kinematics and dynamics with emphasis on conservation laws for linear momentum, angular momentum, and energy. A calculus-based course satisfying degree requirements in all B.S. or A.B. degree programs. Not open to students with credit for Physics 151.

Math corequisite

Math 161 (Calculus I) is a co-requisite of Physics 131. If you haven’t taken Math 161 or an equivalent course already, you should be enrolled in it this semester.

Other introductory physics courses

Everyone is welcome in Physics 131. However, you should be aware of two other introductory physics sequences. 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 with strong previous background in physics may wish to consider the Physics 151 and 152, which proceed at a more rapid pace than sequences which 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 and less math.

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 for orientation this week, and lab experiments will begin the second week of the semester. Further information on lab policies will be given in lab.

Text

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


Make sure you get the thirteenth edition. In Physics 131, we will primarily use chapters 1-10, 12, 21, and 23. We will also briefly dip into chapters 15 and 17. Physics 132 and 133 use 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.

Homework papers are due on Wednesday at 5:00 pm in a bin in the hallway near my office door. Late papers will be accepted for 50% credit from Wednesday 5:00 pm through Friday 5:00 pm.

Portions of the assignments will be done using the MasteringPhysics on-line system. Details will be given in more detail on the first assignment. The 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 three in-class hour exams. They will be given on Fridays: February 21, March 14, and April 18.

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). I will post copies of old exams on moodle.

**Grading**

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

- Homework 15%
- Lab 15%
- Hour Exam #1 15%
- Hour Exam #2 15%
- Hour Exam #3 15%
- Final Exam 25%

Class participation, effort level, etc., may be factored into your final grade after your score is calculated using the above percentages. This will be most important if you are on the borderline between two grades.
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.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Abbreviation</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>tera</td>
<td>T</td>
<td>$10^{12}$</td>
</tr>
<tr>
<td>giga</td>
<td>G</td>
<td>$10^9$</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>$10^6$</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>$10^3$</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>$10^{-2}$</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>$10^{-3}$</td>
</tr>
<tr>
<td>micro</td>
<td>$\mu$</td>
<td>$10^{-6}$</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
<td>$10^{-9}$</td>
</tr>
</tbody>
</table>

The computer industry uses prefixes to represent multiples of 1024 (e.g., 1 kbyte = 1024 bytes), but in Physics 131 we will always interpret them to represent factors of 1000 (1 kbyte = 1000 bytes).

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.

The list below shows the topics we will cover this semester, along with the corresponding sections of the textbook and an estimate of the number of class sessions we will spend on each topic. This list may change as the semester progresses. Specific topic and text coverage will be given on a weekly basis on the homework assignments.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Text Sections</th>
<th>Approximate number of class sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units; velocity; vectors</td>
<td>1.4, 1.7-1.9, 2.1, 3.1, 3.5</td>
<td>3</td>
</tr>
<tr>
<td>Velocity and acceleration, one dimension</td>
<td>2.2-2.5</td>
<td>2</td>
</tr>
<tr>
<td>Velocity and acceleration, multiple dimensions</td>
<td>3.2-3.3</td>
<td>3</td>
</tr>
<tr>
<td>Forces and Newton’s laws</td>
<td>4.1-4.6, 5.1-5.3</td>
<td>5</td>
</tr>
<tr>
<td>Circular motion</td>
<td>3.4, 5.4,</td>
<td>1</td>
</tr>
<tr>
<td>Gravitation and orbits</td>
<td>12.1-12.2, 12.4</td>
<td>1</td>
</tr>
<tr>
<td>Electric force and electric field</td>
<td>21.1-21.7</td>
<td>2</td>
</tr>
<tr>
<td>Energy, dot product, springs</td>
<td>1.10, 6.1-6.3, 7.1-7.2</td>
<td>4</td>
</tr>
<tr>
<td>Electric potential</td>
<td>23.1-23.5</td>
<td>4</td>
</tr>
<tr>
<td>Power, Intensity</td>
<td>6.4, 15.5</td>
<td>1</td>
</tr>
<tr>
<td>Thermal radiation, Earth temperature</td>
<td>17.3, 17.7</td>
<td>2</td>
</tr>
<tr>
<td>Momentum, Center of mass</td>
<td>8.1-8.5</td>
<td>4</td>
</tr>
<tr>
<td>Rotational Motion</td>
<td>9.1-9.5, 10.1-10.7</td>
<td>7</td>
</tr>
</tbody>
</table>
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.
- Perform detailed kinematic calculations in situations such as free-fall or circular motion.
- Use calculus concepts in describing motion.
- Use conservation laws for scalar and vector quantities.
- Solve physical problems involving multiple equations.
- Understand the relations between sources, fields, and potentials.
- Compute equilibrium temperatures of planet surfaces.

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

- NS1. Understand that the goal of science is to comprehend phenomena in the physical and natural world.
- NS2. Employ the fundamental elements of the scientific method:
  - NS2a. Demonstrate the ability to recognize and/or formulate a testable hypothesis based upon observations or existing scientific data;
  - NS2b. Generate, collect, and analyze evidence relevant to testing a hypothesis;
  - NS2c. Evaluate whether the evidence supports or refutes the hypothesis or leads to the development of a new line of inquiry and/or a revision of the original hypothesis.
- NS3. Create, interpret, and critically evaluate descriptions and representations of scientific data including graphs, tables, and models.
- NS4. Understand scientific uncertainty and how it is reduced with additional data acquisition and hypothesis testing.
- NS5. Distinguish the difference between scientifically testable ideas and opinion.

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.

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!