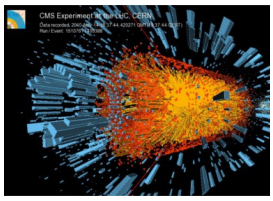
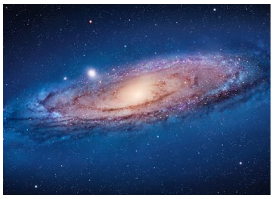
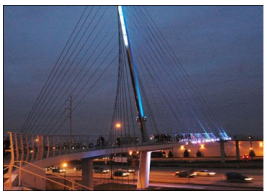





Physics 131
Physics I: Mechanics

Spring Semester, 2017



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General Course Information

This is the first course in a two-semester introductory sequence in physics for students who plan to major in the physical sciences or to enter an engineering program. In this first semester, we will focus primarily on classical mechanics – the study of Newton's laws of motion and how they can be applied to describe and predict how everyday objects (and also some not-so-everyday objects) move and interact with each other. Over the course of the semester, we will be introduced some of the most fundamental concepts in physics – concepts such as energy, momentum, force, and power – and examine the relationships between them. The material that we cover in this course forms the foundation of not only physics, but of chemistry, biology, geology, and every other field of natural science or engineering.

The understanding that you take away from this course will therefore provide you with a deeper understanding and appreciation of how the things we observe in nature and in our daily lives work at the most basic level. In the process of coming to that understanding, you'll get a chance to hone some of the universal skills that are crucial in practically *any* science or engineering field – skills such as setting up an experiment, thinking critically about what you observe, reasoning through problems, and communicating your own knowledge to others. Indeed, by the end of the semester, you can look forward to being able to do all of the following.

- 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.

The prerequisites for this include an understanding of calculus at the level of Math 161, as well as basic algebra and geometry. You should be aware that calculus is an integral part of this course (no pun intended), and that a solid grasp of these mathematical prerequisites is assumed. Understanding this background material will be your responsibility, and if you don't feel comfortable with this material, it's up to you to seek help from the instructors or from elsewhere.

I ask that you join this course with a will to think, to ask questions, to make mistakes, and to try out ideas. Be careful not to confuse understanding with having memorized a lot of facts and formulas. I feel that the former is important while the latter is not – and the former will be far more useful to you in the long run.

Components of the Course

The course will consist of class meetings, reading assignments in the text, some questions and problems, some laboratory experience, thwo mid-term exams, and a final exam. These are described more fully below.

Class Meetings:

Class meetings will be held **from 8:00 AM – 8:50 AM in Hugel 100** each Monday, Wednesday, and Friday during the semester. A schedule of the topics we'll be discussing at each class meeting, along with the corresponding reading assignments, can be found on the course web page. These class meetings are there to help clarify things that you might be confused about after exerting your best efforts at understanding them on your own. However, I emphasize that **not everything can be covered in class; you are responsible for understanding much of the material on your own** by synthesizing what you've learned from your readings, problem sets, lab experiments, exams, and other class activities. It is therefore important that you come to class prepared to ask questions. There are no “dumb” ones. If you don't understand something, chances are there are others who don't understand either or who don't even realize they are missing something.

Class meetings aren't only about lectures either: on most days, we will also have other class activities that are meant to help you understand the material. For example, during class meetings, you will often be working collaboratively in teams of two or three people to come up with solutions to more open-ended problems, such as evaluating a set of proposals for a hydroelectric plant or optimizing the design for a circuit. These kinds of activities are designed provide you with an opportunity to apply what you're learning in ways that more authentically mirror how practicing scientists and engineers actually work. Moreover, it is not unusual for test questions to be based on these activities, so make sure you understand them. For all of these reasons, **regular attendance in class is expected**. You are responsible for knowing anything covered in class, even if you have to miss class for any reason.

WYSCATT ("Why you should care about today's topic"):

One of the goals of this class is to provide you with an better understanding of how the physical principles we're studying relate to our daily lives and to the world around us. Thus, promptly at the beginning of each class period (excepting on days on which we have exams or review sessions), before we do anything else, two or three members of the class will give a short presentation to the class motivating the topic we'll be covering that day. The goal of this presentation is not to explain the physics itself, but to motivate why it's relevant. To do this, you could for example, discuss an interesting technological application of the material we'll be covering, or talk about a natural phenomenon related to that material which we experience in our daily lives.

Each WYSCATT presentation should be about two minutes in length, and each person in the presentation group should speak for at least 30 seconds. These presentations are intended to be fast and informal; a full-on PowerPoint presentation is not required. However, because a picture really is worth a thousand words, your WYSCATT presentation must include **some sort of visual aid**. This can be an image or set of images on a PowerPoint slide (provided that you convert it to PDF format and that you email them to me more that 60 minutes before the beginning of class) or a real object. Your WYSCATT presentations are evaluated primarily based on whether the material you present is relevant and correct. I **strongly recommend that you talk to me ahead of time** about each of your WYSCATT presentations with your presentation group.

The first WYSCATT presentation will take place at the beginning of class on Wednesday, Feb. 1st, and thereafter at the beginning of essentially every class meeting (excepting exam days) throughout the semester. A sign-up sheet for WYSCATT presentations will be made available on Wednesday, Jan. 25th. You need to sign up for **two presentations** during the semester (which need not be with the same group members), and you need to do so **by 1:00 PM on Thursday, Jan. 26th**. This is a large class, so please note that while I will do my best to accommodate your topic preferences, I also reserve the right to make changes to the presentation schedule in order to ensure that all topics are covered.

Readings:

The required textbook for this course is

- Hugh D. Young and Roger A Freedman, *University Physics with Modern Physics with MasteringPhysics,* 14th Ed. (Pearson, 2015).

Readings from the textbook will be assigned for each class meeting, and it is important to do the assigned reading before class. You can't speed-read this stuff; you should go through it with pencil and paper at hand, checking it out as you go.

In addition to the textbook, you will also need to acquire the following supplementary materials for this course:

- **The Physics 131 laboratory manual**, which is available at the Lafayette College Store in the Farinon College Center.
- **An access code for MasteringPhysics**. If you purchase the textbook new from the Lafayette College Store, you will automatically be given an access code. If you choose to acquire the textbook in another way, you may purchase an access code online from Pearson Publishing at http://www.masteringphysics.com/. The course ID for all sections of this course is LAFPHYS131SP2017.
- **A lab notebook**. Please note the your lab notebook for this course must be one of the black, bound lab notebooks available from the Lafayette Bookstore. You and your lab partner will be sharing a single lab notebook, so you should coordinate this purchase with your lab partner.

Homework Assignments:

Homework assignments for this course will include both online exercises from MasteringPhysics and problem sets that you are to submit on paper. A list of the problems included in each homework assignment will be accessible from the course web page. **All problems are due at 4:00 PM on the day (typically a Wednesday) indicated on the course schedule** on that same web page. I will accept late paper-and-pencil exercises for half credit up until 48 hours after the time it is due; whereas the the credit given for MasteringPhysics exercises will gradually decrease to zero over a 48 hour period beginning at the time it is due. Late homework will not be accepted beyond that point without a Dean's Excuse.

Working through problems accomplishes a lot of different things: it gives you practice using the physical principles you're studying, which helps you learn them in a way simple memorization doesn't; it can show you some further interesting consequences of the fundamental ideas; it will teach you how to approach problems; and it will help you discover how well you really understand what you have read. It is essential that you read the relevant sections of the textbook and review your lecture notes thoroughly *before* attempting the homework problems.

Almost all the physics in a problem comes at the beginning, in the process of setting up the problem – you need to understand the physical principles that apply prior to solving the problem. This means you need to think about the physics, not search for the "right equation" – often there *is* no "right equation." The important thing is *not* getting the same numerical answer as in the back of the book, but understanding the physical concepts and how to apply them! In fact, many times, it is a good idea to try and answer the question *qualitatively* prior to plugging numbers into equations. It is also a good idea, once you think you've solved a particular problem, to ask whether your solution seems reasonable – if you have no idea, it probably means that you haven't really understood the problem.

You are encouraged to work on homework problems with other students in the class. This can be a very productive way to study, and working with other people to solve problems is a big part of how science and engineering are really done. However, your written work should

reflect your own understanding and not be a copy of another person's efforts.

Mid-Term Tests and Final Exam**:**

There will be two mid-term exams given during the course: **one on Friday, Feb. 24th and one on Friday, Apr. 7th**. These exams are designed give you the opportunity to demonstrate how well you understand the material. The mid-term exams will focus primarily on material covered since the previous exam (or in the case of the first exam, since the beginning of the course); however, each new topic introduced in this course builds incrementally upon the material we'll have studied previously. In addition, there will also be a final exam at a date and time to be determined by the Registrar.

Laboratory:

You will be performing a variety of laboratory experiments over the course of the semester. These labs are an integral part of this course. Physics is an experimental science and did not really get started in its modern form until people began to do careful, quantitative experiments. The physics lab is a place to test and develop your understanding of the physics you learn in the classroom. Not only is it a chance to see if the ideas being presented are actually true, but it also gives a nice glimpse of how scientific information – and confidence in that information – is acquired.

Further information about the laboratory portion of this course can be found in your lab manual, and further information will be provided by your laboratory instructor during your first lab meeting.

Grading

Course Grade:

Your grade in the course will be determined by the following criteria:

Homework	13%
WYSCATT	4%
Labs	13%
Mid-term Exam 1	20%
Mid-term Exam 2	20%
Final Exam	30%

Office Hours:

You are encouraged to stop by my office at any time if you have questions about any aspect of the course. You may not always find me, however, if you drop by unannounced. My official office hours, during which you can count on my being in my office (except under extraordinary circumstances), will be held **Monday, Wednesday, and Friday from 2:00 – 4:00 PM** unless otherwise noted on the course web page. If you are unable to drop by during these official office hours, you may also call or email me to make an appointment for some other time.

Intellectual Honesty:

All exams in this class are closed-book. Calculators are permitted, and you will also be

provided with a sheet of useful equations and fundamental constants at the start of each exam. However, the use of any other resources is not permitted. When studying, working in the laboratory, or working on homework problems, I encourage you to work with other students. However, you may not consult a solutions manual or any other source for answers to the problems, and the write-up that you submit to me for each problem should be your own work.

As always, you are expected to abide by the principles of intellectual honesty and academic integrity outlined in the Lafayette Student Handbook, which can be found at

- http://studentlife.lafayette.edu/resources/

Other Useful Information

Supplemental Instruction:

A number of Supplemental Instruction (SI) leaders have been appointed for this course. Throughout the course, the SI leaders will lead formal review review sessions and provide drop-in tutoring support for students in this course. **You are strongly encouraged to take advantage of this free resource**. The tutoring schedule for the SI leaders will be made accessible both on the course web page and on the course Moodle page.

Accessibility Services:

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. If you are requesting accommodations, you must register with the Disability Services Office (administered by ATTIC) for disability verification and for the determination of reasonable academic accommodations. It is **your responsibility** to provide me with an official letter from Disability Services which clearly outlines what those accommodations are. I cannot provide accommodations until you provide me with such a letter. Requests for academic accommodations must be made within the first two weeks of the semester, except in unusual circumstances, so that suitable arrangements can be made in a timely manner.

Informal Surveys:

Over the course of the semester, I want to hear from you how you feel the course is going, what you like, what you don't like, what your concerns are, and how you think the course could be improved. Therefore, at regular intervals throughout the semester, you'll have the opportunity to fill out a short, informal course evaluation so that we can get feedback from you.

Course Communication:

This syllabus, a list of assigned readings and problem sets, and other course materials will be posted on the course web page, which can be found at

- http://workbench.lafayette.edu/~thomasbd/Phys131-IntroPhysicsMechanics-Spring-2017/Phys131-IntroPhysicsMechanics-Spring-2017.html

In addition to the course web page, there is also a Moodle page for this course which I will frequently use in distributing course materials, communicating with the class, etc. The Moodle

page can be found at

- https://moodle.lafayette.edu/course/view.php?id=10608

Occasionally, it may be necessary for me to communicate additional information (scheduling changes, clarifications about homework problems, etc.) to the class as a whole. When I do so, I will use your official Lafayette email addresses for all course-related correspondence, so make sure to check your Lafayette email regularly.

Other Sections:

There are four sections of Physics 131 being taught this semester by three different professors. The coverage of topics 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 Phys 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 Physics Lab Coordinator Scott Shelley.

Common Course of Study Outcomes Statement:

This course (and particularly the lab component) will promote the following outcomes for Natural Sciences (NS) within the Lafayette Common Course of Study:

- NS1: Employ the fundamental elements of the scientic method in the physical and natural world.
  - (a) Identify and/or formulate a testable scientific hypothesis.
  - (b) 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.

Moodle Privacy Statement:

Please note that 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. The full policy and practice statement can be found on the Registrar's Office website at

- http://registrar.lafayette.edu/additional-resources/cep-course-proposal/

Winter-Weather Emergencies:

You should assume that class meetings will occur as usual, despite any weather-related issues (including power outages), even if campus offices open late or close early. In the rare event that class must be canceled, I will notify the class by email, and by leaving a voicemail message on my office phone, the number for which is (610) 330-5207.

In Closing

If you have any questions about this syllabus, or about any aspect of the course, please don't hesitate to contact me. By the end of this semester, you can look forward to having both a better understanding of *why* things in the natural world behave the way they do and a practical grasp of *how* to apply fundamental physics principles toward solving the kinds of problems that scientists and engineers grapple with every day of their lives.