Syllabus for 33-131: Matter & Interactions I

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Office hours: Almost any time, but call to see whether someone is there (phone numbers on p. 4)

Course web page: **http://www.andrew.cmu.edu/course/33-131**

Overview of the course

Physics 33-131, which includes classical mechanics and thermal physics, is the first course in a two-semester sequence of introductory calculus-based physics courses offered to science and computer science majors. This course deals with the nature of matter and its interactions. The variety of phenomena that we will be able to explain and understand is very wide, from the orbit of a planet to the speed of sound in a solid.

The main goal of this course is to have you engage in a process central to science: the attempt to model a broad range of physical phenomena using a small set of powerful fundamental principles.

The specific focus is on learning how to explain the nature of matter and its interactions in terms of a small set of physical laws that govern all mechanical interactions, and in terms of the atomic structure of matter.

Textbook

The textbook is *Matter & Interactions I: Modern Mechanics* by Ruth Chabay and Bruce Sherwood (John Wiley & Sons 2002). We will cover almost all of the topics in this textbook. See the table of contents at the front of the book (which also includes the contents of Volume II).

Prerequisites

The math needed is a good knowledge of algebra and a basic knowledge of derivatives, which can be obtained by studying calculus concurrently.

Class meetings

Full-class lecture/discussions are MWF 8:30 in **Doherty Hall 1212**.

Small-group sections are in **Doherty Hall A325** (basement, near connection to the 5th floor of Wean Hall):

TTh 9:30 (section A) Daniel Hennessy, dh2@andrew, office Wean 6404, 8-3771

TTh 12:30 (section C) Daniel Hennessy, dh2@andrew, office Wean 6404, 8-3771

TTh 4:30 (section D) Ruth Chabay, rchabay@andrew, office Hamburg Hall 3039B, 8-5714

Workshop: optional evening problem-solving sessions are in **Doherty Hall A325**.

In-class activities and responsibilities

- You are responsible for attending all classes, and attendance will count toward your grade.
- Bring the textbook and a scientific calculator to class.
- MWF classes will be devoted to lectures, discussions, and experiments.
- Tuesday and Thursday classes will be devoted to working on problems or doing computer modeling.
- If you miss class, it is your responsibility to find out what you missed. Handouts will normally be posted on the course web site, http://www.andrew.cmu.edu/course/33-131

Outside class

You are responsible for the following outside class:

- Read the assignment sheet carefully, study assigned textbook sections, and turn in assigned problems.
- An assignment to study sections of the textbook means:
  - Read the assigned textbook sections thoughtfully.
  - Do the "stop and think" activities.
  - Write brief solutions to the in-line "exercises" and keep them in a notebook.
- Homework solutions must include complete, legible explanations of your work.
- Expect to spend about 7 hours per week outside of class studying for this course.

This is a 12 unit course, which means that in addition to the 5 hours of class per week you are expected to spend about 7 hours studying outside class. If you typically spend much less than 7 hours of outside study, you are unlikely to be able to learn the material. If you typically spend much more than 7 hours of outside study, it is extremely important that you consult with us about ways to study more efficiently.

Quizzes

Usually at the beginning of each Friday lecture/discussion there will be a quiz—come on time! These quizzes are based on class discussions and textbook study.

Exams

There will be three hour exams and a 3-hour final exam. All exams are closed-book, but relevant formulas and constants will be provided where needed. Exams are given in the evening to allow you to take extra time if you need it.

If an unavoidable problem comes up involving illness or family matters, contact the lecturer no later than the day of the exam. Makeup exams will *not* be given (in the case of an *excused* absence we will average your other exam scores).

Grades

The final grade will be determined on the following basis:

40% **final exam (a 3-hour exam covering the whole course)**
35% **three hour exams (see assignment sheets for dates and times)**
15% **homework, including computer problems**
10% **quizzes, attendance**

Exam grades are on an absolute basis: A 88-100%, B 75-87%, C 62-74%, D 50-61%, R 0-49%. There is no "grading on the curve" (grade as rank in class). However, the grade boundaries may be lowered if an exam turns out to be more difficult than intended.

Class attendance

Credit is given for class attendance.

Too many students do not realize how important it is to come to class, and giving credit for attendance is one way of emphasizing its importance. In an introductory physics course where lecture attendance was *not* required, roll was taken in two consecutive lectures. It was found that 87% of the A students came to both lectures, 75% of the B students, 54% of the C students, 33% of the D students, and 10% of those students who were failing. Very similar results have been obtained in calculus and in another introductory physics course. Regular class attendance keeps you well connected to the course, so that you know at all times what's going on, what are the most important points, etc.

The most common cause of missing classes is lack of sleep. If you find that you are getting to bed very late and are missing classes, you need to get help in setting priorities and managing your time, so that you can get adequate sleep and attend classes regularly.

How to use the textbook

A key component of the course is the textbook, in which you are asked to analyze phenomena, to work out small examples, to make some of the steps in derivations, etc.

Textbook study assignments can be done after the associated class discussion, though some students find that they get more out of class if they read ahead. You might try both methods and see which works better for you. The class covers the high points of the new material, and you are expected to go back over all of the assigned material in the textbook and work the exercises in detail, to help fix the new concepts in your mind. *Class discussion will **not** cover all of the assigned material; it is essential that you study the textbook carefully.*

It is important that you take this study assignment seriously, a day at a time. If you ignore the book until it is time to attack an assigned homework problem, you are likely to waste a lot of time floundering around, desperately searching for a nonexistent magic formula somewhere in the chapter that sort of matches the homework problem, and you will lose the opportunity to acquire a deep understanding of the material.

If on the other hand you devote a modest amount of daily time to working through the new sections of the book, you will be in a position to attack the homework problems efficiently, based on a clear understanding of the fundamental physical principles that underlie the analysis of all the homework problems. You will also be well prepared for exams, which test your understanding of fundamental principles rather than your ability to plug numbers into secondary special-case formulas.

Note that at the end of each chapter, just after the summary page, one or more large problems are worked out in detail.

Homework problems

Homework problems will be graded and will count toward the final course grade. Homework is due by the start of the last class (4:30 if due TTh, 8:30 if due MWF); it will receive half credit if handed in by the start of class on the following day; it will not be graded if handed in later without a valid excuse.

Important: Homework must be legible and clearly organized so that we can easily follow your reasoning, or it will be returned. If your initial work is very messy, turn in a second draft.

Computer work

We will assign computer homework, some of which will be done in class, and some to be done outside class. We will teach you the techniques you will need; no previous programming experience is assumed. The computer activities emphasize computer modeling of physical systems and are designed to deepen your understanding of the nature of the modeling process. Computer modeling is an important technique that is playing an increasingly critical role in all of the sciences, parallel to theory and experiment.

Computer programming is a powerful tool, but even the most skilled programmer sometimes gets waylaid by a computer problem that is very difficult to "debug." For that reason we make the following rule:

> If you have worked seriously for an hour trying without success to debug a malfunctioning computer program, ***STOP!*** Get help from an instructor or from another student before continuing. We do not want you to spend hours and hours struggling with computer problems. We will make adjustments of deadlines when we work with you. However, you have the responsibility to start on an assignment early enough to be able to get help if necessary. Don't wait until 2 AM of the day the assignment is due!

A "Computer Information" handout will explain how to turn in computer homework. Computer problems are submitted electronically and are due at 11 PM on the due date.

Miniproject

Later in the semester there will be a miniproject assignment to extend one of your models. When you do a problem (computer or paper), think about something you might like to do to extend the model, as a possible candidate for a miniproject.

Collaborative work

Scientists and engineers normally work in groups, and social interactions are critical to their work. Most good ideas grow out of discussions with colleagues. In this course we want you to work with others as much as possible. Study together, help your partners to get over confusions, ask each other questions, and critique each others' homework write-ups. Teach each other! You can learn a great deal by teaching. But do turn in your own writeups, and do list your partners with whom you worked, just as researchers cite collaborators in their papers.

While collaboration is the rule in technical work, evaluations of individuals also play an important role in science and engineering. Exams and quizzes are to be done without help from others. Cheating will be heavily penalized in accord with university regulations.

Help

You should ask lots of questions in class to clear up any initial confusion you might have about a topic. If you fall behind for any reason, please let us know as soon as possible. The sooner we know about these situations, the better we can help you make up work. We will do what we can to help you complete the course satisfactorily, but an incomplete grade cannot be given simply because you fell behind.

An optional workshop will be open certain evenings in the recitation room, Doherty Hall A325. Come to work with other students on physics problems, with an instructor present to whom you can direct questions.

Finding our offices

The offices of Ruth Chabay and Bruce Sherwood are in Hamburg Hall, the large building at the bottom of the hill on Forbes (4800 Forbes). **This is *not* Hammerschlag Hall!**

Ruth Chabay	3039B Hamburg Hall	8-5714	rchabay@cmu.edu
Bruce Sherwood	3041 Hamburg Hal	8-8530	bruce.sherwood@cmu.edu

- Take the elevator to the third floor of Hamburg Hall and walk straight ahead.
- After you are forced to turn right, go through the glass door on your right (labeled Center for Innovation in Learning). This door is at the center of the third floor.
- Go past the CIL mail boxes and turn left down a hallway to room 3039B or 3041.

Mailboxes

All instructors have mailboxes in the Department of Physics mail room, Wean Hall 7322. If you leave something in a mailbox, please leave an email or voicemail message alerting the instructor to look for it.

Also, there are mailboxes for Ruth Chabay and Bruce Sherwood in Hamburg Hall on your left after going through the glass door to the Center for Innovation in Learning.