Syllabus for Physics 181-01 and 181-03, Spring 2017

Class Hours and Location:

Section 01, Mondays and Wednesdays, 11:35 AM-12:50 PM
Section 03, Mondays and Wednesdays, 1:00 PM-2:15 PM

Classroom: SPL 59

Contact Information:

Instructor: Adriane Steinacker
e-mail: Adriane.steinacker@yale.edu

Office: 56 Hillhouse Ave, room #106, located on the left side at the main entrance.

Office hours and Study Hall:

Office hours (possibly subject to change) all held in 56 HLH, room 106:
Mondays and Tuesdays: 3:30PM-5:30PM
Wednesdays and Thursdays: 3:30PM-6:30PM

Study Hall: Mondays, Tuesdays, Thursdays, 7PM-10PM, Location: HLH 17, room 101

Course Goals

The range of backgrounds and motivations for this course is, by nature, very broad. While the need for mastering Physics at an introductory level is obvious for Physics, Chemistry and Engineering majors, it may appear less so for the Life Sciences or Computer Science. Physics constitutes the foundation on which an understanding of Chemistry and Biology can be built. It explains how the world works on a fundamental level. Beyond this, a solid training in Physics helps develop analytical skills, which are required in every part of our technology and information-based society. More importantly, building and retaining an ability to perform tasks that today are increasingly directed to machines could be of crucial importance in surviving as a species against the rise of artificial intelligence. Physics provides a framework for constructing complicated systems from simple building blocks, or reducing a complex problem to its simplest parts. Acquiring the skill of lucidly thinking through problems is, in my opinion, the most important goal in physics education. As a doctor, you will face situations that require out of the box thinking. As an engineer, you will build on the flawless theoretical concepts to make things work, from microchips to bridges. As a citizen of this planet, you have the right and the duty to be informed and to verify claims. Even in our day-to-day existence, the ability to solve problems can transpire from physics to mundane tasks.

In short, the series of introductory physics courses constitute a stepping-stone toward achieving a better understanding of the world, and toward becoming a better problem solver across the board.

Course Website: The primary platform for communication and for accessing class materials is *Canvas*. Please make sure to have an account on this site and be good about reading the e-mails sent to you when I post an announcement.

Textbook: Although I am not a "by-the-book" instructor, and I would like to reserve the right to occasionally introduce ideas differently, or depart from the order of topics found in a book, it can be useful to have a standard reference for reading. The book adopted for this course is "*Fundamentals of Physics" by David Halliday and Robert Resnick*, 10th edition (chapters 21-33 and 34 or 37). You are completely welcome to use older editions of this book.

Lecture Notes: Aside from the above textbook, from which I will assign reading prior to each class, I also type up my lecture notes, and these will be available after class on the course website.

Expected Course Work

Your grade will be made up of three contributions:

1) Homework, 35%. The purpose of the homework is to review topics covered during one week of class, to get deeply involved in thinking about the material, and ultimately to prepare for the exams. Homework problems might, at times, walk you through a situation or concept not covered in lecture. In short, the homework is an excellent venue for checking whether you truly understand the material. The homework also is a good way of getting used to clear written communication. I value detail, clarity and transparency of the solutions, which is often augmented with the presentation of a sketch. The use of graphical devices in written and oral presentation of scientific content has established itself as undeniably useful over many centuries.

Homework sets are assigned weekly on Fridays and posted on the Canvas course website. They are due on the following Friday by 5 PM. You may turn in late homework for partial credit up to two days from the due date, i.e. until Sunday by 5 PM, with a penalty of 25% per day. **A Dean's excuse is required to turn in late homework without penalty**!

The first homework will be due on Friday, January 27. The homework submission should be done in pdf format via the course website under the "*Assignments*" tab. Scanned versions of hand-written work is probably less time consuming than typing.

2) Exams. There will be three exams, scheduled on the following days:

Midterm 1: Wednesday, February 8 (in class).

Midterm 2: Wednesday, March 8 (in class).

These will each make up 15% of your grade.

You may turn in a revision of your midterm exams for up to 50% of the points you lost on the original score. For example, if you obtained a 60% score on the exam, with a perfect revision, you can gain an additional 20%, so your final score will be 80% after you turned in the revised version.

Final Exam: Thursday, May 4, 7PM (location to be announced). This exam makes up 25% of the grade.

The goal of the exams is to verify where you stand in terms of your understanding of the material when it comes to working independently, without relying on resources, and within a limited amount of time. This is a much-valued skill in many jobs! On the other hand, the exam results allow me to identify areas of difficulty and to react to help individuals improve. The progression in performance from one exam to the next, allows me to evaluate the effectiveness of my instruction.

I will announce the topics covered during each exam and I will hold a review prior to each exam. The final exam is cumulative with an emphasis on the topics not tested previously. In general, keep in mind that the topics covered in this course build on one another and it is, therefore, advisable to strive to retain what one has learned. Moreover, the material we will cover next semester is heavily built on the foundation you will acquire during this term.

All exams are closed books, closed notes, in-class exams. A formula sheet will be provided and only the formulas on the sheet may be used for solving the problems. If you are choosing to use a formula that does not appear on the formula sheet, you must know how to derive it and show the derivation. No credit will be given for the usage of a formula that does not appear on the sheet without proper backup.

3) In Class Participation: 10% of the total grade.

For some of the lectures, I will think of a few fundamental questions related to the material presented during a particular lecture, which I would like you to spend a few minutes thinking about and working out on paper, either with your neighbors or individually. I will collect these papers and we will discuss the problem either during the same lecture or next. Please make sure to always submit your "in-class quiz" sheet!

Summary of Grade Breakdown:

Homework: 35%
Midterm 1 and Midterm 2: 15% each
Final Exam: 25%

Participation: 10%

The completion fraction for the homework is 90% and for the participation it is 80%.

Typical Grade Boundaries

Score in %	Grade
90-100	A, A-
70-90	B-, B, B+
55-70	C-, C, C+
40-55	D
0-40	F

Please note that the above grade boundaries might change slightly, depending on the level of difficulty of the homework and the exams. If, for instance, the final exam turns out too hard, I will rescale the scores.

Needed Equipment: Rulers and triangles, graphing paper, a regular scientific calculator (not your cell phone and not a graphing calculator). During the exams, using the graphing function of your calculators is not permitted. Some of you may profit from a set of colored pencils.

Academic Integrity: While I encourage students to work together in groups, either in preparation for the weekly homework, or for the exams, each student must ensure a thorough understanding of the material and the problems solved. After your group study session or section, you should always write up your work individually. These problems will serve you as great examples in your preparation for the exams, or for later use. Being able to rework your group's effort will show you whether you really understood everything.

During exams, all work presented must be your own. Any cases of cheating will be dealt with in accordance with the corresponding University regulations against academic dishonesty.

Email Policy: I will do my best to answers e-mails promptly, but please keep in mind that I spend a considerable fraction of my days in classrooms, or working with students and away from Email. Please don't leave questions to the last minute! On any day, I will answer e-mails in order of their arrival up to 6PM in the evening. I will answer all e-mails sent after this time on the next day.

Tentative List of Topics

Please note that, although this is a classical curriculum, the list of topic may change for a number of reasons. Most often, this happens because one might work faster or more slowly with a specific group of people. It is also possible that one topic not mentioned below could be of interest to a group of students, or I might find it appropriate to introduce it in a given context.

1) Introduction and Motivation. Charges, conductors, insulators, the Electrostatic Force (Classes 1 and 2).
2) The Electric Field, probing the Electric Dipole Field (Class 3).
3) The electric field of continuous charge distributions – The parallel plate capacitor (Class 4).
4) Motion of the dipole in a uniform electric field (Class 5).
5) Electric Flux and Gauss's Law (Class 6).
6) Applications of Gauss's Law - Electric field of charge distributions, revisited (Class 7).
7) Electric Potential, electrostatic potential energy (Class 8).
8) Equipotential surfaces, determining the electric field from the potential. The Van de Graaff Generator, breakdown electric field and potential (Class 9).
9) Capacitors, capacitance. Electrostatic energy stored in a capacitor (Class 10).
10) Capacitors in series and parallel. Dielectrics (Class 11).
11) Electric current, resistance, Ohm's Law, resistivity (Class 12).
12) RC circuits. Charging and discharging a capacitor (Class 13).
13) Direct Current Circuits (series and parallel). Power (Class 14)
14) The electromotive force, emf, terminal voltage. Junction, resistance, and emf rule for DC current circuits. The Ammeter and the voltmeter (Class 15).
15) The Magnetic Field: discovery, sources, permeability constant, the Biot-Savart-Law and applications (Class 16).
16) Motion of a point charge in a magnetic field. Lorentz Force. The magnetic force between two parallel wires. (Class 17)
17) The e/m ratio, cyclotron motion, frequency, helical paths, magnetic mirrors. Motion of charges in a uniform electric field. The discovery of the electron and elementary charge (Class 18).
18) Torque on a current loop. The magnetic dipole, magnetic moment. The electric motor (Class 19)
19) Magnetic flux, Faraday's Law, induced current and induced emf. Lenz's Law (Class 20)
20) A simple generator. Induction and energy transfer. Inductance, Energy stored in a magnetic field (Class 21).
21) LC and LR circuits (Class 22).
22) Alternate Current Circuits (Class 23).
23) Maxwell's Equations. The speed of light (Class 24).

Time permitting, if we get ahead of schedule: Principles of Optics or Special Relativity.