# Physics 4B, Section 35Z & 48Z
## Physics for Scientists and Engineers: Electricity & Magnetism
### De Anza College, Fall 2021

**Instructor: Chien-I Chiang** **Email: chiangchien-i@fhda.edu**

**Class Meeting:** M/W 5:30PM – 7:45PM @**Zoom**
M(Sec.35Z)/W(Sec.48Z) 7:55PM – 10:45PM @**Zoom**
**Office hours:** M/W 5:05PM – 5:30PM @ Zoom
Friday 5:30PM – 5:55PM @Zoom
**Credit:** 6 units

***Be sure to check the announcement and resources on Canvas frequently**

## Course Objective

Welcome to PHYS-4B! This course introduces electromagnetic interaction, one of the fundamental interactions of nature that we most commonly observe, alongside with gravity, in our daily life. The emphasis will be on both ***conceptual understanding*** and ***quantitative calculations***, in particular using calculus in physics. Starting from **electric charges** and **electric forces**, we will introduce the notion of **electric field** and **electric potential**, as well as utilizing **symmetries** in problem-solving. We will then discuss the relation between these ideas and **electric circuits.** After the study of electrostatics, we will turn our focus to **magnetic force** and **magnetic field.** We will first see that magnetic interactions are closely related to electricity in the sense that moving electric charges create and feel magnetic fields. Not only that, we will further see that **time-varying magnetic field creates electric field and vice versa**. The class will end with the emphasis on the unification of electricity and magnetism under Maxwell's equations, and show that **electromagnetic (EM) waves** are solutions to Maxwell's equations and the light we observe in daily life is a kind of EM waves.

## Textbook

The required textbook is ***Physics for Scientists and Engineers with Modern Physics***, by **Serway**. Any edition is fine. I'll also post my own lecture notes to Canvas.

## Problem Sets/Quizzes

Problem sets will be given in the form of pdf posted on Canvas. The problem sets will not be collected. **However, it is your responsibility to ensure that you finish the problems within the expected time frame. You HAVE to do the problems, or you won't do well in the quizzes.**

To prompt you to finish the problems on time, **four quizzes** will be given throughout the quarter. The quizzes will be based on the problems in the HW assignments. No makeup quizzes are allowed, but **lowest quizzes will be dropped.**

## Lab

**The attendance to weekly lab sections are required. A one-third of letter grade will be deducted (e.g. A- to B+) for *each* unexcused lab after one unexcused absence.** You do not need to purchase any lab manual or workbook. **The pdf files for the labs will be posted on Canvas before the lab.** The *tentative* dates for the labs can be found in the tentative schedule appended to the syllabus.

The aims of the labs are to help you understand the physical concepts covered in class, as well as learning the basic skills of analyzing data and **presenting your results concisely and clearly.**

**Labs are done in a group of three or four people.** You need to actively participate the labs in order to receive full credit. Write the names of your lab partners at the top right-hand corner of the lab report. The lab reports are due at the end of class. ***You are required to have me check your lab reports/worksheets before you log off Zoom.***

## Exams

There will be **two midterm exams** and **one *cumulative* final exam**. The tentative dates for the two exams are:

**MT1: Monday, 10/25, in class**
**MT2: Monday, 11/22, in class**
**Final: Monday, 12/6, starting 6:15 per college schedule**

Calculators, nor any other electronic devices, are not allowed to the exams. You won't need them as the exams will have few, if any, numerical problems.

Due to remote learning/exams, the exams will be open book. More detailed policy will be given as the exam approaches. With that said, I would still like to list the ***usual* policy below (which will NOT be implemented this quarter due to remote learning)**. **You should study in a way that can prepare you for close book exams as described below, which will render a stronger preparation overall:**

*"A list of very basic mathematical formulas will be given with the exams. However, **physical equations will not be provided. You are required to remember all the important equations you need.** You are NOT allowed to bring your own personal notes to the exam. This is not to encourage you to memorize equations. Instead, the aim is encouraging you to internalize them by **repeating derivations** and solving problems."*

Due to logistic difficulties, **no make-up exams will be given for any reason.** If you cannot take the exams due to medical conditions or other extenuating circumstances, official documents are required to make *possible* accommodations. You must take the final exam to pass the course.

You need to show your work on all exams. Correct answers without supporting work will not receive credit. Full credit will only be given when you explicitly show the logical steps in a clear manner. Please make sure your handwriting is recognizable to help the grading process.

## Study Guide

Physics is a hard subject, no matter who teach it or learn it. It was a hard subject for me when I first learned this. But I deeply believe with the necessary efforts invested, it is also a subject that ordinary people can learn. It's not a subject for few smart people. It can be frustrating some time but try to be patient and persistent. I am aware of the cultural and academic challenges associated to college-level physics class. Know that no matter your background, you are in this class because you are capable of doing the work and learning the material. I believe in your academic potential, and if you let me, I will help you become a stronger student by supporting you and challenging you. Below are some items that are worth to keep in mind when you study:

1. Studying physics takes a lot of time. Although this varies person by person, if the goal is to get an A for this class, **at least 8hrs/week** outside the class meetings is most likely needed. With that said, I also have to be honest that, in a physics class, it is possible that one spends the huge effort (say more than 10hrs/week) and still cannot get an A. However, I try my best to frame my course in a way such that hardworking students can at least get a B.
2. **Understanding derivations of important formulas and being able to reproduce them is vital** for understanding the physics. In the exams, I will ask you to derive equations.
3. I do not encourage memorizing formulas. However, if you find yourself frequently referring to formula sheets, that's usually a sign of not being familiar with the material enough.
4. Do not randomly search for equations and manipulate them. Understand the context of a given equation; know when you can and cannot use an equation.
5. Imitation is an important process for learning physics. Study the example problems carefully and try to mimic the way of solving problems.
6. Do not leave things behind. Make sure you understand the example and exercise problems given in the lecture. If you don't understand anything I said, **please do not hesitate to ask!**
7. Make this class a positive mathematical experience by **collaborating with your peers and learning from one another.**

## Grade

The course grade is based on your scores in homework assignments, labs and exams, with the following weighting:

Quizzes 12%
Labs 8%
MT1 23%
MT2 23%
Final 34%

The final letter grade is assigned based on **EITHER** the grading curve -- that is ***about*** 30% A/A-, 40% B+/B/B- and 30% C+/C/C-/lower – **OR** the following table, whichever is advantageous to you:

| Course Grade | Letter Grade | GPA |
|---|---|---|
| Outstanding | A+ | 4.0 |
| $\geqq$89% | A | 4.0 |
| 86%$\leqq$ x < 89% | A- | 3.7 |
| 80%$\leqq$ x < 86% | B+ | 3.3 |
| 75%$\leqq$ x < 80% | B | 3.0 |
| 70%$\leqq$ x < 75% | B- | 2.7 |
| 65%$\leqq$ x < 70% | C+ | 2.3 |
| 60%$\leqq$ x < 65% | C | 2.0 |
| 55%$\leqq$ x < 60% | C- | 1.7 |
| 50%$\leqq$ x < 55% | D | 1.0 |
| x < 50% | F | 0.0 |

* ***This grading scale—at my sole discretion—may be shifted downward if needed.***

## ** You must take the final exam to pass the course.*

**Physics 4B Sec.35Z&48Z** **Fall 2021**

# Tentative Schedule

| Date | Wk | Day | Lecture Topics | Quizzes | Discussion/Lab |
|---|---|---|---|---|---|
| 9/20 | 1 | M | Introduction; Electric Charge; Electric Force | | Lab 0: Uncertainty, Error Propagation, Excel |
| 9/22 | | W | Electric Field of Point Charges; Motion of Charged Particles in E-field | | |
| 9/27 | 2 | M | E-Field of Continuous Charge Distribution | **Quiz 1** | Lab 1: Coulomb's Law |
| 9/29 | | W | Electric Flux, Gauss's Law, Conductors in Equilibrium I | | |
| 10/4 | 3 | M | Symmetry, Finding E-Field with Gauss's Law | | Lab 2: Electric Potential |
| 10/6 | | W | Work and Potential Energy, Electric Potential Energy, Path-independence | | |
| 10/11 | 4 | M | Electric Potential, E from V, Conductors in Equilibrium I | **Quiz 2** | Lab 3: Capacitor |
| 10/13 | | W | E and V of Electric Dipole, U of Dipole **(Tentative cutoff of MT1)** | | |
| 10/18 | 5 | M | Electric current density, conductivity and resistivity, Resistence and Ohm's law | | MT1 Practice Exam |
| 10/20 | | W | Kirchoff's Loop and Junction Rule, DC Circuit | | |
| 10/25 | 6 | M | **Midterm 1** | | Lab 4: DC Circuit |
| 10/27 | | W | Capacitor and Dielectrics; RC Circuit | | |
| 11/1 | 7 | M | Right-hand-rule and B force on moving charge particle; Biot-Savart Law | | Lab 5: Magnetic Field Lines |
| 11/3 | | W | Ampere's Law and Magnetic Field of Current Distribution | | |
| 11/8 | 8 | M | Magnetic force between wires, Magnetic Dipole and Torque | **Quiz 3** | Lab 6: Particles in Magnetic Field |
| 11/10 | | W | Lenz's Law, Faraday's Law | | |
| 11/15 | 9 | M | Motional EMF **(Tentative cutoff of MT2)** | | MT2 Practice Exam |
| 11/17 | | W | Transformers, Inductors, LR Circuit | | |
| 11/22 | 10 | M | **Midterm 2** | | TBD |
| 11/24 | | W | LC Circuit; RLC Circuit | | |
| 11/29 | 11 | M | Speed of light from Maxwell's Eq. Properties of EM Waves | | Lab 7: AC Circuit Lab |
| 12/1 | | W | Buffer/Review | **Quiz 4** | |
| 12/6 | 12 | M | **Final Exam** (***cumulative***) starting at **6:15 PM per college schedule** | | |
| 12/8 | | W | | | |

* The schedule is tentative, and it may be changed according to the pace of the class.

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**Student Learning Outcome(s):**

*Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of electricity and magnetism.

*Gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.