

PHYS 4B: Physics for Scientists and Engineers: Electricity and Magnetism

Instructor: Farzad Taiedi

Time and location: PHYSD004B63 MW 5:30 – 7:45 (DA-S75)

My Website: <https://sites.google.com/site/physicsclub/>

Office Hours: TR 4:30 – 5:30 (DA-S-13)

Email: taiedifarzad@fhda.edu

Prerequisites:

Prerequisite: PHYS 4A; MATH 1C (may be taken concurrently). Advisory: EWRT 211 and READ 211 (or LART 211), or ESL 272 and 273.

Textbook:

Serway/Jewett, "Physics for Scientist and Engineers", 9th edition, Pearson, 2014. Supporting text: Freedman and Young, "University Physics", 14th edition, Pearson, 2015.

Course Description:

An introduction to classical electromagnetism. Includes DC and AC circuits and elementary field theory.

Expanded Description: Content and Form

A. Discuss electrostatics and electric potential, and apply to solve related problems.

1. Understand the concept of electric charge
2. Analyze the properties of conductors and insulators
3. Analyze Coulomb's Law
4. Analyze the concept of electric field
 - a. Electric Field lines
 - b. superposition principle for electric field
 - c. Calculating electric field from different charge distributions
5. Analyze Gauss's Law

- a. Electric Flux
 - b. Application of Gauss's Law
6. Understand the concept of electric potential
- a. Equipotential surfaces
 - b. Superposition principle for electric potential
 - c. Calculating electric potential for different charge distributions
 - d. Electric potential energy

B. Analyze resistance, capacitance, DC Circuits, and compute related quantities.

1. Understand the concept of resistance
- a. Current
 - b. Resistivity
 - c. Resistance
 - d. Series and parallel configurations
 - e. EMF
2. Understand the concept of capacitance
- a. Capacitors
 - b. Capacitance
 - c. Dielectrics
 - d. Series and parallel configurations
 - e. Energy stored in a capacitor
3. Analyze DC circuits
- a. Kirchhoff's Rules
 - b. RC circuits
 - c. Energy and power in DC circuits
 - d. Ammeters and voltmeters

C. Discuss magnetic fields and forces, and solve related problems.

1. Understand the concept of magnetism
2. Explore magnetic fields
 - a. Magnetic field lines
 - b. Magnetic flux
 - c. Gauss's Law for magnetism
 - d. Magnetic field of stationary and moving charges
3. Analyze the concept of magnetic force
 - a. Magnetic force on a moving charge
 - b. Magnetic force between current-carrying conductors
 - c. Applications of charged particle motion in magnetic fields
4. Analyze magnetic force and torque on a current loop
5. Analyze Ampere's Law

D. Explain electromagnetic induction and inductance, and solve related problems.

1. Examine the concept of induction
 - a. Faraday's Law
 - b. Lenz's Law
2. Analyze motional EMF
3. Understand the concept of inductance
 - a. Inductors
 - b. Energy stored
 - c. Self-inductance
 - d. Mutual inductance
4. Analyze inductors in circuits
 - a. RL circuits
 - b. LC circuits
 - c. LRC circuits

E. Apply the principles of DC circuits and circuit elements to AC circuits.

1. Understand the concept of resistors, inductors, and capacitors in an AC circuit
2. Analyze RLC series circuit
3. Understand phasors
4. Understand reactance
5. Analyze the concept of resonance in AC circuits
6. Analyze the properties of transformers

F. Explain electromagnetic waves.

1. Analyze Maxwell's Equations
2. Understand the electromagnetic spectrum

G. Analyze data using graphical, statistical, and computer-based techniques.

1. Understand how to make accurate measurements and understand the uncertainties associated with them
2. Analyze data to induce scientific conclusions
3. Collaborate with others as a team to produce collective results
4. Learn how to use and collect data using several electronic devices relevant to the discipline of electricity and magnetism

Homework Assignments:

Students are required to register online to access the homework website: www.webassign.net and do homework online. I encourage you to form small groups for discussing the materials presented in the class, in the book and the homework. Try to explain to each other; explaining to others is the best way to clarify your understanding. However, do not split the work load; the final homework, solutions and their entries should be done individually. Make sure you don't fall behind the lectures by attempting all the homework problems and submitting it before the due date. It is strongly recommended that students go through the following steps before attempting the homework problems:

Study the lecture notes and the relevant chapter of the textbook. Study problems that are worked out in the lecture and those in the textbook, noting the goal and strategy used.

Online Registration:

You will have an access code in a package in your book if you bought it new. If you buy a used book or an eBook you will have to purchase access to the online homework separately, see Textbook above and options on www.coursemart.com. Follow the instruction inside the *WebAssign Student Access Code* package for online registration. For this you need:

- Your personal access code, which is inside your package.
- A valid email address
- The class key ID, which can be obtained from instructor.

Class Activity and weekly Quizzes:

Attending classes and participating in the class discussions and weekly problem practice sessions, by forming study groups, is very important. There will be quizzes based on these activities that will carry 40% of your final grade. The request to reschedule an exam must be done before or on the day of the exam, while weekly quiz makeups are not possible. Note: If there is a dispute in the grading of any exam homework, quiz, or exam I will consider looking at them a second time only if it is handed back to me within 2 school days after I return them.

Examinations:

There will be two midterms and a final comprehensive examination. The midterms and final will be based on the course description above and the questions will be closely related to class activities and homework assignments. All exams will be closed book, closed note, except for a formula sheet prepared and provided by instructor. Each exam will have 4-7 problems and can include multiple-choice questions.

Grading:

Homework 10%, Lab 15%, quizzes 40%, two mid-terms, each 10%, final 15%. Final Letter grades will be assigned according to the following percentage of maximum points earned.

A⁻, A, A⁺	> 85 – 100%
B⁻, B, B⁺	>70 - 85%
C⁻, C, C⁺	>55 – 70%
D⁻, D, D⁺	> 40 – 55%
F	below 40%

Lab Topics:

- A. Measuring Resistance
- B. Ohmic and non-ohmic resistors
- C. DC circuits
- D. Introduction to the Oscilloscope
- E. RC series circuits
- F. The Magnetic Force on a Current Carrying Wire
- G. The E/M experiment
- H. LR Circuits and Phase differences
- I. Real world data collection

De Anza College Academic Integrity:

“The following types of misconduct for which students are subject to disciplinary sanctions apply at all times on campus as well as to any-off campus functions sponsored or supervised by the college:

Cheating, plagiarism or knowingly furnishing false information in the classroom or to a college officer”

This statement implies that if a student intentionally copies another students work or a ‘solution manual’ the student will be subject to disciplinary action.