

PHYSICS DEPARTMENT

COURSE OUTLINE

PHYS 210 ELECTRICITY AND MAGNETISM

A calculus-based course in electricity and magnetism. Topics include electrostatics; capacitance; dielectrics; electric circuits; magnetic fields; electromagnetic induction; Maxwell's equations.

OFFERED:	Winter, Quarter 1
CREDIT:	4
IN-CLASS WORKLOAD:	4 lecture, 2 lab (Winter semester) 5 lecture, 2 lab (Quarter 1)
PREREQUISITES:	Physics 115 and Math 101 or admission to the ENGBRIDGE program. <i>Math 235 or Math 250A recommended.</i>

REQUIRED MATERIALS:

Textbook: Physics for Scientists & Engineers with Modern Physics, 6th edition,
Serway, R.A., and Jewett, J.W.Jr.

Physics 210 lab manual

Hardcover laboratory notebook

Graph paper (must be either 10 lines/inch or millimeter graph paper)

DEPARTMENT POLICIES REGARDING TESTING:

1. Students must write quizzes, tests, midterm tests, etc., on the date and time assigned by the instructor. Instructors are not required to provide make-up tests. At their discretion, instructors may waive a test or provide a make-up test only in the event of documented illness or other extenuating circumstances.
2. Midterm tests may be dropped if: (a) a first-class mark is obtained on the comprehensive final exam, and (b) all term work has been completed and is judged to be satisfactory. In this case, the final grade for the course may be based on a combination of the final exam and the lab mark.

DEPARTMENT POLICIES REGARDING LABS:

1. All assigned laboratory exercises and reports must be completed with an overall grade of 60% in order to obtain credit for this course. A lab may be waived or made up at a later time only in the case of documented illness or other extenuating circumstances.
2. A student who is repeating a Physics course does not have to complete the laboratory exercises a second time if an average lab grade of 70% or better was obtained.

STUDY TIME

It is recommended that between 5 and 10 hours per week (or more for students with a weak background) be spent studying for this course outside of class time.

GRADING

The standard mark distribution for this course is as follows:

Final Exam	50%
Midterm	30%
<u>Lab Reports and other work</u>	<u>20%</u>
	100%

This distribution may be amended by the instructor (see your Instructor's Information sheet).

GRADE SCALE

Final letter grades are normally assigned as follows (subject to above conditions):

Percentage	Letter Grade
95 to 100	A+
90 to 94	A
85 to 89	A-
80 to 84	B+
75 to 79	B
70 to 74	B-
65 to 69	C+
60 to 64	C
50 to 59	D
below 50	F

OUTLINE:

1. **Electric charge**

- 1.1 Electromagnetism as a fundamental force of nature
- 1.2 Coulomb's law
- 1.3 Conservation and quantization of charge

2. **The Electric Field**

- 2.1 Electric field calculations for charge distributions of high symmetry
- 2.2 Electric flux
- 2.3 Gauss' law

3. **Electric Potential**

- 3.1 Equipotential surfaces
- 3.2 Calculation of potential due to charge distributions of high symmetry

4. **Capacitance**

- 4.1 Combinations of capacitors
- 4.2 Energy storage in capacitors
- 4.3 Dielectrics

5. **Electrical circuits**

- 5.1 Review
 - 5.1.1 Current
 - 5.1.2 Voltage
 - 5.1.3 Resistance
 - 5.1.4 Ohm's law
- 5.2 Series and parallel circuits
- 5.3 Kirchhoff's rules

6. **Magnetism**

- 6.1 Force on a current-carrying conductor
- 6.2 Torque on a current loop
- 6.3 The magnetic dipole
- 6.4 Magnetic flux

7. Sources of Magnetic Fields

- 7.1 The Biot-Savart law
- 7.2 Ampere's law
- 7.3 Magnetic force on a current-carrying wire
- 7.4 Solenoids and toroids

8. Electromagnetic Induction

- 8.1 Faraday's law
- 8.2 Lenz's law
- 8.3 Eddy currents

9. Inductance

- 9.1 Capacitors and inductance
- 9.2 Inductance
- 9.3 Self-inductance
- 9.4 The LR circuit
- 9.5 Stored energy in the magnetic field of an inductor

10. Electromagnetic oscillations and alternating current – Optional material

- 10.1 *Damped LC oscillations*
- 10.2 *Forced oscillations and resonance*
- 10.3 *Series LCR circuit*
- 10.4 *Impedance*
- 10.5 *RMS currents*
- 10.6 *Transformers*

11. Introduction to Maxwell's equations – Optional material

12. General magnetic properties of matter – Optional material