

CRITICAL PERFORMANCE STATEMENT

By the end of this course, students will have demonstrated the ability to analyze a variety of phenomenon in electromagnetism such as electric charges and their interaction with electric and magnetic fields as well as current, inductors, capacitors, and electrical properties of circuits.

Course/Subject Description:

Students analyze Coulomb's law, Gauss' law, Kirchhoff's laws, Ampere's law, Ohm's law, Faraday's Law, Lenz's law and energy theorems as well as their applications to a variety of phenomena including static charges, currents and magnetic fields, circuits, power, induction, coils, and solenoids. Students participate in interactive lectures and are evaluated by assignments, quizzes, and exams. This course has a separate mandatory laboratory session every week as PHY 108L.

Method(s) of Instruction: Multiple methods of delivery are anticipated: Classroom lectures, Discussions and/or presentations, Interactive simulations.

Content Outline by Module:**MODULE 1:**

- Electric Charge
- Coulomb's Law
- Electric field
- Electric field lines
- Electric field due to a point charge, electric dipole, line of charge and charged disk
- Movement of charge in an electric field

MODULE 2:

- Flux
- Gauss' Law
- Application of Gauss' Law: Cylindrical, spherical and planar symmetry

MODULE 3:

- Electric potential energy and electric potential
- Equipotential surface
- Calculating potential from the field
- Potential due to a point charge and a group of point charges
- Potential due to continuous charge distribution
- Conductors in electrostatic equilibrium

MODULE 4:

- Capacitance
- Capacitors in series and in parallel
- Energy stored in an electric field
- Capacitors with dielectric

MODULE 5:

- Electric current, resistance and Ohm's law
- Resistors in series and parallel
- Power in electric circuits
- Kirchhoff's laws and solving circuits
- RC circuits

MODULE 6:

- Magnetic fields
- Hall effect
- Biot-savart law
- Torque on a current loop
- Magnetic dipole moment
- Magnetic field due to a current
- Force between two parallel currents
- Ampere's law
- Solenoid

MODULE 7:

- Faraday's law of induction
- Lenz's law
- Induction and energy transfer
- Induced electric field
- Inductors and inductance
- Self-induction
- Energy stored in a magnetic field
- Mutual induction
- LR circuit

MODULE 8:

- LC circuit
- Maxwell's equations

Actual Contact Hours: Lecture - 3 Hours/week, Laboratory - 3 Hours / week.

Method(s) evaluation of student performance:

Quiz	15%
Assignment	10%
Attendance	10%
Midterm Exam	30%
Final Exam	35%

Textbook Requirements:

David Halliday, Robert Resnick, and Jearl Walker, *Fundamentals of Physics* (10th ed., 2013), John Wiley & Sons, Inc., New York, NY.

Learning Outcomes:

- CO - 1 Calculate electrical quantities such as electric force, electric field, electric flux and electric potential of distributions of electric charge and different combination of electric charges using Coulomb law and Gauss' law.
- CO – 2 Compute capacitance and resistance of simple capacitors and resistors as well as series, parallel and series-parallel arrangements of capacitors and resistors.
- CO – 3 Analyze Ohm's and Kirchhoff's laws by evaluating electric current and power in simple DC circuits involving resistors and batteries.
- CO - 4 Analyze the effect of magnetic fields on the motion of an electric charge, as well as the force and torque on a current carrying wire in a magnetic field.
- CO – 5 Calculate the magnetic field due to currents in wires, coils, and solenoids using Biot-Savart law and Ampere's law.
- CO – 6 Apply Faraday's law of induction and Lenz's law to analyze induced emf and current as well as the phenomenon of self-induction and mutual induction.

Rationale for the Course

Physics II provides students with essential concepts and techniques from electricity and magnetism for core engineering science courses.

Pre-Requisites

Physics I (PHY 107) and Calculus II (MAT 130)

Mapping of Course Outcomes

	Course Outcomes (CO)	Bloom's taxonomy domain/level (C: Cognitive P: Psychomotor A: Affective)	Delivery methods and activities	Assessment tools
CO - 1	Calculate electrical quantities such as electric force, electric field, electric flux and electric potential of distributions of electric charge and different combination of electric charges using Coulomb law and Gauss' law.	C2, C3, P2	Lecture, Interactive simulations and Discussion	Quiz, Assignment, and Midterm Exam
CO - 2	Compute capacitance and resistance of simple capacitors and resistors as well as series, parallel and series-parallel arrangements of capacitors and resistors.	C2, C3, P2	Lecture and discussion	Quiz, Midterm exam, and Assignment
CO - 3	Analyze Ohm's and Kirchhoff's laws by evaluating electric current and power in simple DC circuits involving resistors and batteries.	C4, P2	Lecture, Interactive simulation and Discussion	Quiz and Midterm Exam,
CO - 4	Analyze the effect of magnetic fields on the motion of an electric charge, as well as the force and torque on a current carrying wire in a magnetic field.	C4, P2	Lecture, Interactive simulation and discussion	Quiz and Assignment
CO - 5	Calculate the magnetic field due to currents in wires, coils, and solenoids using Biot-Savart law and Ampere's law.	C2, C3, P2	Lecture and discussion	Quiz and Assignment
CO - 6	Apply Faraday's law of induction and Lenz's law to analyze induced emf and current as well as the phenomenon of self-induction and mutual induction.	C3, P2	Lecture, Interactive simulation, and discussion	Final Exam