Kingdom of Saudi Arabia
Al-Imam Muhammad Ibn Saud Islamic University
Faculty of Sciences
Department of Physics

PHY 220 – Electricity and Magnetism

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
PHY	220	Electricity and Magnetism	3	3	0	1	PHY 101, MAT 102

Student Learning Objectives

Upon completion of the course, students will be able to

- Explain how electric current can generate a magnetic field.
- Develop and enhance their knowledge and understanding of the concepts of electricity and magnetism

Syllabus (13 Weeks)

- Electric Potential Difference (06 H): Electric Fields and the movement of charge, Electric field lines, Electric potential, Electric potential difference., Electrical potential energy, The electron volt, Electrical potential due to a point charge.

- Electric Circuits (08 H): Current, Power , work , resistance, Ohm's law, Circuit Connections: Circuit symbols and circuit diagrams, series circuits, Parallel, Circuits, combination circuits.

- Electrostatics (10 H): Electrical forces and charges, Conservation of charge, Coulomb's law, Conductors and insulators, Charging by friction and contact, Charging by induction, Charge polarization, Fields and potentials of planar charge distributions, Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and application – Electric potential – Electric field and equipotential plots – Electric field in free space, conductors, dielectric -Dielectric polarization - Dielectric strength - Electric field in multiple dielectrics

- Capacitance (04 h): definition of capacitance, calculating Capacitance for parallel plate capacitors, connection of capacitors, energy stored in a charged capacitor.

Sources of the Magnetic Field: the Biot-Savart's law, the magnetic force

- Magnetism (06 h): Magnetic poles, Magnetic fields, Nature of a magnetic field, Magnetic domains, Electric currents and magnetic fields, Magnetic forces on moving charged particles, Magnetic forces on current-carrying wires, Magnets and magnetic fields, Magnetic field produced by electrical currents, Domain theory, Force on an electric current in a magnetic field, Force on a moving charge in a magnetic field, Applications,

-Electromagnetic induction (12 H): Induced EMF , Faraday's law, Lenz's law, Ampere's Law – Magnetic field due to straight conductors, circular loop, infinite sheet of current – Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization – Magnetic field in multiple media –Magnetic force – Torque – Inductance – Energy density – Magnetic circuits. generators and motors, Eddy currents

- Inductance (06 H) : self-inductance, RL circuits, energy in a magnetic field, mutual inductance, oscillation in an LC circuit, the RLC circuit.

Text Book:

Reference Books:

1- Introduction to Electrodynamics, Griffiths, D. J. 3rd edition. Prentice Hall, (1999).
2- Electricity and Magnetism Purcell, E.M. (Berkeley Physics Course, vol. 2),
3- Physics for Scientists and Engineers (with modern physics) –by Raymond A. Serway, and John W. Jewett – Brooks Cole – 6th Edition (July 21, 2003)
4- Randall D. Knight, physics for scientists and engineers with modern physics, (December, 2003).

Experiments

1- Electrostatic Force
2- Forces and Torques on Magnetic Dipoles
3- Equipotential Lines and Electric Fields
4- Ohm's Law
5- RC and LC Circuits
6- Magnetic Fields
7- Magnetic Force
8- Dipoles in B Fields
9- Magnetic Forces
10-Faraday's Law
11-LR and LRC Circuits
12- RLC Circuit