| Course Title | Course Code | Number of Study Hours | | | Year | Level | Prerequisites |
|---|---|---|---|---|---|---|---|
| | | Theoretical | Laboratory | Credit | | | |
| Electricity and Magnetism | 231PHYS | 3 | 2 | 4 | 2nd | 3rd | --- |

**(1) Brief Course Description**

This course discusses basic concepts in some topics of electricity and magnetism. The topics includes; electrostatic charges, Coulomb's law, electrostatic field, Gauss's law and its applications, electrostatic potential, capacitance and dielectrics, magnetic forces, magnetic field and its applications, and electromagnetic induction.

**(2) Course Objectives**

**This course is designed to provide students with:**

- The concepts of electrostatic charges, electrostatic field, electrostatic potential, capacitance and dielectrics, magnetic forces, magnetic field, and electromagnetic induction.
- Coulomb's law, Gauss's law, Biot-Savart law, Ampere's law, Faraday's law and Lenz's law.
- Problems relating to the above topics.
- Laboratory experiments to understand the related concepts.

**(3) Course Contents**

**Theoretical Part:**

- **Electric Fields**: **Electric Fields**: Properties of electric charges, Coulomb's law, the electric field, electric field of a continuous charge distribution, the electric field lines, motion of charged particles in a uniform electric field.
- **Gauss's Law**: Electric flux, Gauss's law, application of Gauss's law to various charge distributions, Conductors in electrostatic equilibrium.
- **Electric Potential**: Potential difference and electric potential, potential difference in a uniform electric field, electric potential and potential energy due to point charges, obtaining the value of electric field from the electric potential, electric potential due to continuous charge distributions.
- **Capacitance and Dielectrics**: Definition of capacitance, calculating capacitance, combinations of capacitors, energy stored in charged capacitor, capacitors with dielectrics, an atomic description of dielectrics.
- **Magnetic Fields:** magnetic fields and forces, magnetic forces acting on a current carrying conductor, torque in a current loop in a uniform magnetic field, motion of charged particle in a uniform magnetic field.
- **Sources of the Magnetic Field:** Biot–Savart law, magnetic forces between two parallel conductors, Ampere's law, magnetic field of a solenoid, magnetic flux, Gauss's law in magnetism, magnetism in matter.
- **Faraday's Law:** Faraday's law of induction, motional e.m.f, Lenz law, generators and motors, Maxwell's equations.

**Experimental Part:**

- Determination of unknown resistance using Meter Bridge.
- Determination of the internal resistance of a battery.
- Determination of the electrical resistivity of a wire conductor.
- Verification of series and parallel connections of capacitors.
- Determination of the magnetic force acting on a current carrying conductor in a magnetic field.
- Determination of the magnetic field due to short and long solenoids.
- Studying the charge-time curve through charging and discharging capacitors.

**(4) Assessment Criteria**

- Periodic Exams: 20%
- Oral, Student Activity and Essay: 10%
- Laboratory Work: 20 %
- Final Exam: 50 %

**(5) Course Teaching Strategies**

- Lectures, Reports and Essay Assignments, Homework, and Web-based Assignments.

**(6) Text Book**

- Physics for Scientists& Engineers with Modern Physics; 7th edition, Serway, Saunders Golden Sunburst Series, 2007.

**(7) Reference Books**

- University Physics; H. Young and R. Freedman, Addison-Wesley Publishing Company, Inc., 11th edition, 2004.
- Fundamentals of Physics; Halliday, Resnik and Walker, John Wiley and Sons Inc., 2007.
- Electricity and magnetism, Berkeley Physics Course Volume 2, Edward M. Purcell 1990.