

Physics Program

Unit 2: Electricity and magnetism

Chapter I

Electrostatic (4 weeks)

1. Electric Charge

- ✓ Methods of Electrification
- ✓ Nature of Charge.
- ✓ Quantification of Charge.
- ✓ Conservation of charge.

2. Conductors and Insulators

- ✓ Explain what a conductor is.
- ✓ Explain what an insulator is.
- ✓ List the differences and similarities between conductors and insulators.

3. Coulomb's Law

- ✓ Describe the electric force.
- ✓ Calculate the force that points charges exert on each other.
- ✓ Determine the direction of the electric force for different source charges.
- ✓ Correctly describe and apply the superposition principle for multiple points charges.

4. Electric Field

- ✓ Explain the purpose of the electric field concept.
- ✓ Calculate the electric field due to a point charge
- ✓ Describe the properties of the electric field.
- ✓ Calculate the field of a collection of point charges of either sign.

5. Electric Potential

- ✓ Calculate the potential due to a point charge
- ✓ Calculate the potential of a system of multiple point charges

6. Electric Potential Energy

- ✓ Define the work done by an electric force
- ✓ Define electric potential energy
- ✓ Apply work and potential energy in systems with electric charges.

7. Calculating Electric Fields and potential of Charge Distributions

- ✓ Explain what a continuous source charge distribution.
- ✓ Describe line charges, surface charges, and volume charges
- ✓ Calculate the field and potential in this case.

8. Field lines and Equipotential Surfaces

- ✓ Explain the purpose of an electric field diagram and equipotential surface
- ✓ Explain the relationship between equipotential lines and electric field lines

9. Determining Field from Potential

- ✓ Explain how to calculate the electric field in a system from the given potential
- ✓ Calculate the electric field in a given direction from a given potential
- ✓ Calculate the electric field throughout space from a given potential

10. Gauss's Law

- ✓ Define electric flux
- ✓ Calculate electric flux for a given situation
- ✓ State Gauss's law
- ✓ Explain the conditions under which Gauss's law may be used
- ✓ Apply Gauss's law in appropriate systems

Chapter II Conductors in Electrostatic Equilibrium (2 weeks)

1. Properties of conductor in electrostatic equilibrium

- ✓ Define conductor in equilibrium

- ✓ Distribution of Charges on Conductors, the equipotential lines and electric field.

2. Electrostatic induction phenomenon

- ✓ Explain partial Electrostatic induction phenomenon
- ✓ Explain total Electrostatic induction phenomenon

3. Capacitors and Capacitance

- ✓ Explain the concepts of a capacitor and its capacitance.
- ✓ Describe how to evaluate the capacitance of a system of conductors.
- ✓ Explain how to determine the equivalent capacitance of capacitors in series and in parallel combinations.

Chapter III Conductors in Electrostatic Equilibrium (3weeks)

1. Current and Resistance

- ✓ Describe an electrical current
- ✓ Explain the direction of current flow
- ✓ Model of Conduction in Metals
- ✓ Current Density
- ✓ Define the term resistivity
- ✓ Define the term conductivity
- ✓ Define Resistance

2. Ohm's Law

- ✓ Describe Ohm's law
- ✓ Ohm's law applies.

3. Electrical Energy and Power

- ✓ Express electrical power in terms of the voltage and the current
- ✓ The power dissipated by a resistor

4. Direct-Current Circuits

- ✓ Electromotive Force
- ✓ Voltage source

- ✓ Efficiency of the generator.

5. Kirchhoff's Rules

- ✓ State Kirchhoff's junction rule
- ✓ State Kirchhoff's loop rule
- ✓ Analyze complex circuits using Kirchhoff's rules

Chapter IV MAGNETOSTATICS (2weeks)

- 1. Magnetic field generated by a magnet**
- 2. Magnetic Fields Produced by Electrical Currents**
- 3. Biot-Savart Law**
- 4. Ampère's Law**
- 5. Action of a magnetic field on the motion of an electric charge.**
 - ✓ Lenz's Force
- 6. Action of a magnetic field on an electric current**
 - ✓ Faraday's Force