

## **Course-IV: ELECTRICITY, MAGNETISM AND ELECTRONICS**

### **UNIT-I**

#### **1. Electrostatics: (6hrs)**

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged solid sphere and (ii) an infinite conducting sheet of charge, Deduction of Coulomb's law from Gauss law, Electrical potential-Equipotential surfaces, Potential due to a (i) dipole (ii) uniformly charged sphere

#### **2. Dielectrics: (6 hrs)**

Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics, Dielectric strength, Capacitance of a parallel plate condenser with dielectric slab between the plates, Electric displacement  $D$ , electric polarization  $P$ , Relation between  $D$ ,  $E$  and  $P$ , Dielectric constant and electric susceptibility.

### **UNIT-II**

#### **3. Magnetostatics: (6 hrs)**

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Divergence and curl of magnetic field, Ampere's Circuital Law and its application to Solenoid, Hall effect, determination of Hall coefficient and applications.

#### **4. Electromagnetic Induction: (6 hrs)**

Faraday's laws of electromagnetic induction, Lenz's law, Self induction and Mutual induction, Self inductance of a long solenoid, Mutual inductance of two coils, Energy stored in magnetic field, Eddy currents and Electromagnetic damping

### **UNIT-III**

#### **5. Alternating currents: (6 hrs)**

Alternating current - Relation between current and voltage in LR and CR circuits, Phasor and Vector diagrams, LCR series and parallel resonant circuit,  $Q$  -factor, Power in ac circuits, Power factor.

**6. Electromagnetic waves-Maxwell's equations: (6hrs)** Idea of displacement current, Maxwell's equations-Derivation, Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, Poynting theorem (Statement and proof)

## **UNIT-IV**

### **7. Basic Electronic devices: (12 hrs)**

PN junction diode, Zener diode and Light Emitting Diode (LED) and their I-V characteristics, Zener diode as a regulator- Transistors and its operation, CB, CE and CC configurations, Input and output characteristics of a transistor in CE mode, Relation between  $\alpha$ ,  $\beta$  and  $\gamma$ ; Hybrid parameters, Determination of hybrid parameters from transistor characteristics; Transistor as an amplifier.

## **UNIT-V:**

### **8. Digital Electronics: (12 hrs)**

Number systems, Conversion of binary to decimal system and vice versa, Binary addition & Binary subtraction (1's and 2's complement methods), Laws of Boolean algebra, DeMorgan's laws-Statements and Proofs, Basic logic gates, NAND and NOR as universal gates, Exclusive-OR gate, Half adder and Full adder circuits.

### **Practical Course IV: Electricity, Magnetism and Electronics**

#### **Minimum of 6 experiments to be done and recorded**

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchhoff's laws and Maximum Power Transfer theorem.
5. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
6. PN Junction Diode Characteristics
7. Zener Diode –V-I Characteristics
8. Zener Diode as a voltage regulator
9. Transistor CE Characteristics- Determination of hybrid parameters
10. Logic Gates- OR, AND, NOT and NAND gates. Verification of Truth Tables.
11. Verification of De Morgan's Theorems.
12. Construction of Half adder and Full adders-Verification of truth tables