Physics II (BCSPHYT102)

Unit I: Electric Current and Electromagnetic Induction [10h]

Electric Current: Current Density, Equation of continuity, Kirchhoff's laws, Rise and Decay of currents in LR circuit, Rise and Decay of charge in CR, Decay of charge in LCR.

Electromagnetic induction: Faraday's laws, Lenz's law, self-induction and mutual induction.

Unit II: a.c. circuits [10h]

Transformer: Theory, Principle of working and its applications.

Application of complex number in solving an a.c. circuit, j-operator method: a.c. applied to pure resistive circuit, a.c. applied to pure capacitive circuit, a.c. applied to pure inductive circuit, a.c. applied to LR circuit, a.c. applied to CR circuit, a.c. applied to series LCR circuit, a.c. applied to parallel LCR circuit. Power in a.c. circuit, wattless current, power factor (PF).

Unit III: Magnetostatics [10h]

Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a rectangular current loop, Biot-Savart's law: Calculation of B for straight conductor, circular coil. Ampere's Law and its applications for the magnetic field for solenoid and toroid. Non-existence of magnetic monopole.

Field due to a magnetic dipole, free and bound currents, Magnetic dipole moment, angular momentum and gyromagnetic ratio. Magnetization vector (M), relationship between B, H and M. Magnetic susceptibility and permeability relationship.

Unit IV: Magnetism [10h]

Introduction of dia, para and ferro-magnetic materials. Langevin's theory of diamagnetism, its application as superconductor, critical magnetic field and Meissner effect, classical Langevin's theory of paramagnetism (without derivation), ferromagnetism, ferromagnetic domain, Curie-Weiss Law, curie temperature, Anti-ferromagnetism, Neel temperature ferrimagnetism, ferrites and its applications, Hysteresis loss (B-H curve).

Unit V: Kinetic theory of gases and Transport phenomenon in gases [10h]

Kinetic theory of gases: assumptions, Boyle's law, equipartition of energy and its applications to specific heat of gases; monatomic and diatomic gases, molecular collision, mean free path and collision cross section, estimate of molecular diameter and mean free path.

Transport phenomenon in gases: Transport of mass, momentum, energy and their relationship,

dependence on temperature and pressure, Vander Waal's gas (Real gas, Equation of state), critical constants.

Unit VI: Thermodynamics [10h]

Zeroth Law of thermodynamics, first law of thermodynamics, conversion of heat into work, applications of first law, work done during isothermal and adiabatic processes, reversible & irreversible processes, second law & entropy, third law of thermodynamics, unattainability of absolute zero. Carnot's cycle, Carnot's theorem, entropy changes in reversible & irreversible processes, entropy temperature (TS) diagrams, Maxwell's relations & applications - Joule-Thomson Effect, Clausius Clapeyron Equation.

Reference Books for Theory:

1. University physics, by H. D. Young, R. A. Freedman: Pearson
2. Electricity and Magnetism, by Satya Prakash: Pragati Prakashan
3. Basic Electrical Engineering, B.L. Thareja: S. Chand
4. Electricity and Magnetism: B. Ghosh: Books and Allied Publisher
5. Heat, Thermodynamics and Statistical Physics by Singhal, Agrawal: Pragati Prakashan
6. Heat, thermodynamics and statistical physics by Brijlal, Subramayam and Hemne: S. Chand

Laboratory – 2
(BCSPHYP102)

List of Experiments: (Any 10) [40h]

1. To determine the time constant (τ) of CR circuit.

2. To determine the unknown inductance (L) using series LR circuit.

3. To determine the unknown capacitance using series CR circuit.

4. To determine the frequency of a.c. mains (n) using Fleming's left hand rule.

5. To determine the quality factor (Q) of a series LCR a.c. circuit.

6. To study the characteristics of a transformer.

7. To determine (γ) ratio of specific heats of gas by Clement and Desorm's method.

8. To determine the thermal conductivity of a bad conductor by Lee's disc method.

9. To determine the horizontal component of Earth's magnetic field and magnetic moment of the magnet.

10. To study the variation of magnetic field along the axis of a current carrying circular coil.

11. To study of magnetic field by vibration magnetometer.

12. To determine the magnetic susceptibility of $FeCl_3$ solution.

13. To calculate the mechanical equivalent of heat by Calender and Barn's constant flow method.

14. To study the variation of total thermal radiation with temperature using the torch bulb filament.

Reference Books for Practicals:

1. Advanced Practical Physics for students by B.L. Flint & H.T. Worsnop: Asia Publishing House.
2. A Text Book of Practical Physics by Indu Prakash and Ramakrishna: Kitab Mahal, New Delhi.
3. Physics through experiments by B Saraf et. al. : Vikas Publications.
4. Advanced practical physics by Chauhan & Singh: Pragati Prakashan.
5. Practical Physics by D. Chattopadhyaya et al: Central Publications.