UNIT - V

9. What is Thomson scattering? Derive the expression for the cross-section of Thomson scattering. What are the applications of Thomson scattering?
2 + 10 + 2 = 14

10. Provide a brief overview of Mie scattering and its significance in the context of particle scattering. Define the phase function and explain its role in describing scattering patterns. 10 + 2 +2 = 14

★★★

PG (NEP) EVEN SEMESTER EXAMINATION, 2023

PHYSICS

2nd Semester

Course No. : PHY - 551

(Electromagnetic Theory)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions, taking one from each unit)

UNIT - I

1. Consider a charged particle moving through an electromagnetic field. Derive the Lagrangian of the charged particle interacting with electromagnetic fields. Using the principle of least action, derive the equation of motion for the particle. Discuss the significance of each term in the Lorentz force equation and explain how it incorporates the effects of electric and magnetic forces on the particle's motion. 8 + 4 + 2 = 14

2. Derive the Lorentz transformation equations for time and space coordinates between two inertial

frames moving with a relative velocity 'v' along the x-axis. Show how these transformations reduce to the Galilean transformations in the limit of low velocities. Discuss the key differences between Lorentz transformations and Galilean transformations, highlighting their implications for the principles of special relativity. 8 + 3 + 3 = 14

UNIT - II

3. Discuss the motion of a charged particle in a uniform electric field in the relativistic and non-relativistic limits. 14

4. Define and explain the concept of adiabatic invariants in the context of charged particle motion in electromagnetic fields. Discuss how these invariants arise and why they are important in describing the behavior of charged particles in time-varying magnetic and electric fields.
6 + 4 +4 = 14

UNIT - III

5. (a) Explain Saha's equation of ionization in the context of plasma physics. Discuss its significance in understanding the ionization state of plasma. 6 + 3 = 9

(b) Define and discuss the Debye length in plasma. Explain its significance in characterizing the screening effects due to charged particles in plasma. 3 + 2 = 5

6. What are plasma oscillations? Derive the dispersion relation for plasma oscillations and analyze the behavior of the waves in terms of the dielectric constant. Discuss the distinction between longitudinal and transverse plasma waves.
2 + 6 + 6 = 14

UNIT - IV

7. What are retarded potentials? How are these potentials used to calculate the field of an accelerated point charge? What are the advantages of using retarded potentials? 4 + 6 + 4 = 14

8. (a) What are Lienard-Wiechert potentials? 6

(b) Explain the concept of power radiated by a dipole and the factors that influence its radiated power. Derive the formula for the power radiated by a non-relativistic dipole in terms of its acceleration and dipole moment. 3 + 5 = 8