PG Even Semester Examination, May 2025

PHYSICS

(2nd Semester)

Course No.: PHYCC-551

(Electromagnetic Theory)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

The figures in the right margin indicate full marks for the question.
Answer any five questions selecting one from each unit.

UNIT-I

1. Derive the Lorentz transformation equation for a four vector in tensor form. Hence derive the transformation relations for momentum and force four vectors. 8+3+3=14

2. Formulate the Lagrangian of a relativistic charged particle. Hence define four potential and discuss its physical significance. Derive Lorentz force equation. 6+3+5=15

UNIT-II

3. (a) Discuss the motion of an electron under the combine influence of a static, uniform and orthogonal electric and magnetic fields. 8

   (b) Discuss the principle of magnetic mirror. 6

4. What are ΔB drift and curvature drift? Discuss their properties in connection with the motion of an electron in non-uniform magnetic field. 2+2+10=14

UNIT-III

5. (a) Explain quasi-neutrality and collective behavior of plasma. 7

   (b) Find and expression for Debye's length and hence express the condition of quasineutrality in terms of it. 7

6. How do Maxwell's equations lead to the dispersion relation for electromagnetic waves in a plasma? Differentiate between electromagnetic (transverse) and electrostatic (longitudinal) oscillations in plasma. 6+4+4=14

UNIT-IV

7. What are Lienard-Viechart potentials? Show that an oscillating electric diplole radiates electromagnetic waves. 4+10=14

8. What is retarded poetential? Calculate the quadrupole radiation field in near distance approximation. 4+10=14

UNIT-V

9. (a) Derive the expression for differential scattering cross-section of electromagnetic wave for a free charged particle. 7

   (b) If the incident radiation be unpolarized obtain the expression for total cross-section. 7

10. (a) Discuss the theory of Mie Scattering for spherical particle. 8

    (b) Write notes on : T-Martix and Discrete Dipole Approximation. 3+3=6

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