PG Even Semester (CBCS) Exam., May—2018

PHYSICS

(2nd Semester)

Course No. : PHYCC–201

(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. *(a)* Write the postulates of special theory of relativity. Obtain Lorentz transformation equations in tensor form.

(b) Formulate the Lagrangian of a relativistic charged particle and from this Lagrangian, obtain the equation of motion. 2+5+5+2=14

2. Derive transformation equations for electric and magnetic field vectors using Lorentz covariants. Show that the product EB is invariant under Lorentz transformation. 7+7=14

UNIT—II

3. Find an expression for plasma drift velocity considering the motion of a charged particle in presence of both electric and magnetic fields that are constant in time and spatially uniform. Hence show that resulting motion of the particle is a cycloid in the plane normal to the magnetic field. 10+4=14

4. *(a)* Show that the magnetic moment in an inhomogeneous magnetic field is invariant.

(b) Discuss the principle of magnetic mirror effect. 7+7=14

UNIT—III

5. *(a)* What is a plasma? Considering the physical mechanism of plasma oscillation, derive the expression for plasma frequency.

(b) Deduce Saha's ionization condition and discuss it. 2+5+7=14

6. *(a)* Explain why Debye shielding length increases with increase in temperature. Obtain an expression for $_D$ (Debye length) and explain how it characterizes a plasma.

(b) A solar corona consists of ionized hydrogen with approximately 10^{12} particles/m^3. Assuming the field in the corona to be 1000 gauss, calculate the phase velocity of Alfven waves. 3+4+7=14

UNIT—IV

7. What is Lienard-Wiechart potential? Derive the expression for electric and magnetic fields produced by a charged particle moving with uniform velocity. 6+8=14

8. Obtain an expression for power radiated by an oscillating electric dipole. Discuss the distribution pattern of radiated power. 12+2=14

UNIT—V

9. *(a)* Find the total scattering cross-section for the scattering of an unpolarized wave by a free charged particle.

(b) Show that

$$\text{bound} \quad \frac{4}{4_0}$$

where symbols have their usual meanings. 8+6=14

10. Discuss the theory of Mie scattering. Hence derive an expression for phase function. 10+4=14

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