M.Sc. Semester–II (CBCS Scheme) Examination

PHYSICS

Paper–2-PHY-1 Electrodynamics–I

Time : Three Hours] [Maximum Marks : 80

Note :— All questions are compulsory and carry equal marks.

1. (a) Explain the energy density in an electrostatic electric field. 7

   (b) Define :

   (i) Line Integral

   (ii) Surface Integral. 4

   (c) Explain flux of a vector field. 5

OR

   (p) Let f = f(x, y, z) and g = g(x, y, z) be two differentiable scalar fields. Prove that : grad f X grad g is solenoidal. 7

   (q) Prove that : $\vec{E} = -\vec{\nabla} V$ 4

   (r) Explain the electric energy for a arbitrary charge distribution. 5

2. (a) Obtain an expression for electric field in Cartesian coordinates. 7

   (b) An infinitely long rectangular metal pipe is grounded but one end at x=0 is maintained at a specified potential $V_o(y, z)$. Find the potential inside the pipe. 6

   (c) Explain the method of electrical images. 3

OR

   (p) Derive an expression for electrical potential using spherical polar coordinates. 7

   (q) Find potential charge distribution within conducting spherical boundary using Green's function. 5

   (r) Define Green's function with respect to the potential problem. 4

3. (a) Deduce an expression for the magnetic field at a point due to a certain distance from a conducting straight wire. 7

(b) Deduce an expression for magnetic field at a centre of circular loop. 6

(c) Explain Lorentz force equation. 3

OR

(p) Define magnetic moment and derive an expression for gyromagnetic ratio. 7

(q) Find magnetic field due to solenoid. 6

(r) State Ampere's circuital law. 3

4. (a) Show that potential at any point due to any charge distribution is the sum of potential by several multipole moments. 7

(b) Establish the relation between $\vec{P}$, $\vec{E}$ and $\vec{D}$. 5

(c) Explain the behaviour of dielectric in uniform electric field. 4

OR

(p) Estimate the field outside the dielectric sphere when it is placed in uniform electric field. 7

(q) Derive the relation between electric susceptibility and molecular polarizability. 5

(r) Explain polar and non-polar molecules. 4

5. (a) Show that electromagnetic waves travel in free space with the speed of light. 6

(b) Write Maxwell's equations with their word statement. 4

(c) Explain displacement current and find total current density. 6

OR

(p) Show that $(\vec{E} \times \vec{H})$ represents the rate of flow of energy per unit area. 7

(q) Derive wave equation for scalar and vector potentials. 5

(r) Explain in brief Faraday's Law of electromagnetic induction. 4