Exam. Code : 209002
Subject Code : 4886

M.Sc. Physics 2nd Semester

ELECTRODYNAMICS–I

Paper—Phy-452

Time Allowed—2 Hours] [Maximum Marks—100

Note :— There are **EIGHT** questions of equal marks. Candidates are required to attempt any **FOUR** questions.

1. Use multipole expansion to determine approximate potential at points far off from a physical dipole which consists of two equal and opposite charges (±q) separated by a distance 'd'.
2. (a) Derive an expression for electric field at a distance 'z' on the axis of a circular ring of radius 'R' carrying a uniform linear charge density 'λ'.
   (b) Derive an expression for electrostatic energy stored in a dielectric medium.
3. (a) Using Biot-Savart's Law, obtain an expression for magnetic field at a distance 's' from an infinite straight wire carrying current 'I'.
   (b) Determine an expression for torque on a magnetic dipole placed in a uniform magnetic field.

4. (a) Introduce the idea of magnetic vector potential. Obtain mathematically an expression for $\vec{A}(\vec{r})$ in terms of volume current density. Also write the corresponding expressions for line and surface currents.
   (b) Define 'B', 'H' and 'M'. Give their respective units.
5. (a) How Maxwell fixed Ampere's Law ? Discuss in detail. Hence write Maxwells equations in a region of space containing (i) free charges and currents and (ii) no free charge and currents.
   (b) Obtain an expression for energy stored inside the magnetic field.
6. Discuss and obtain mathematical expressions of :
   (a) Continuity equation
   (b) Poynting's theorem.
7. Discuss the propagation and attenuation of waves inside a conducting medium using Maxwell's equations. Obtain explicit expressions for $\vec{E}$ & $\vec{B}$ inside the conductor.
8. (a) Give points of difference between transverse and longitudinal waves.
   (b) Explain the terms linear and circular polarised waves giving suitable mathematical formula for each.
   (c) Show that a stretched string having tension 'T' and mass per unit length 'μ' supports wave motion when plucked.