

M.Sc. F.Y. (Physics) (CBCS Pattern) Sem-I
PSCPHYT04 : Electrodynamics-I

P. Pages : 2

Time : Three Hours



GUG/W/22/11182

Max. Marks : 80

Notes : 1. All questions are compulsory.

Either:

1. a) State and explain Gauss law & derive its differential form. **6**
- b) Derive electric field and obtain its expression for discrete, line, surface and volume charge distribution. **4**
- c) Find the electric field due to spherically symmetric distribution. **6**
- i) At an external point ($r > R$)
- ii) At an internal point ($r < R$)
- by considering a sphere of radius R & charge q .

OR

- e) Explain Dirac Delta function with their properties & show that $\delta(k_x) = \frac{1}{|k|} \delta(x)$. **6**
- f) What is an electric potential? Derive an expression for potential due to dipole at a point **10**
- i) On its axis ii) On equatorial line

Either:

2. a) State & prove first and second uniqueness theorem. **8**
- b) Derive an expression for method of separation of variable by using cartesian co-ordinate system. **8**

OR

- e) Derive an expression for multiple expansion of potential. Explain monopole & dipole term. **8**
- f) State & prove Green's theorem. **8**

Either:

3. a) State & prove Biot Savart law **4**
- b) Find the magnetic field a distance 'Z' above the centre of circular loop of radius 'R' which carry a steady current. **4**
- c) Derive an expression for Ampere's law in differential form. **8**

OR

- e) Discuss magnetostatic boundary condition in details. 6
- f) Explain magnetic shielding. 4
- g) Derive & discuss the variation of \vec{B} at outside, inside the surface of a long solenoid. 6

Either:

- 4. a) State & explain the Faraday's law of electromagnetic induction in differential form. 8
- b) Show that $J_d = \frac{\partial D}{\partial t}$ by using Maxwell equation in matter, where J_d - displacement current. 8

OR

- e) State & prove Poyntings theorem. 8
- f) Discuss scalar & vector potential. 4
- g) Discuss Gauge transformation. 4

5. Answer all of the following.

- a) Derive Poisson's & Laplace equation. 4
- b) Show that $V(r, \theta) = \sum_{\ell=0}^{\infty} \left[A_{\ell} \cdot r^{\ell} + \frac{B_{\ell}}{r^{\ell+1}} \right] \cdot P_{\ell}(\cos \theta)$. 4
- c) Discuss magnetic moment details. 4
- d) How did Maxwell modified Ampere's Law & why? 4
