M.Sc.- I (Physics) (CBCS Pattern) Sem-I

PSCPHYT04 - Paper-IV - Core-IV : Electrodynamics-I

P. Pages : 2 **GUG/W/22/11182**

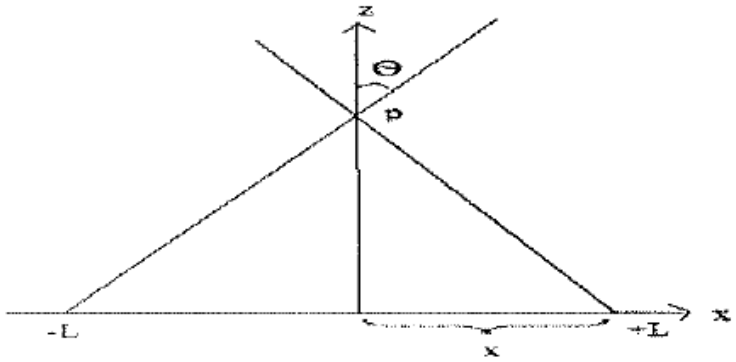
Time : Three Hours * 1 9 3 6 * Max. Marks : 80

Either :

1. a) State and explain Coulomb's law in vector form. **4**

b) Derive the equation for electrostatic energy of a continuous charge distribution. **6**

c) Find the electric field a distance z above the midpoint of a straight line segment of length 2L, which carries a uniform line charge λ **6**



OR

e) State and explain Gauss's law. **4**

f) Find the electric field for a infinite plane which carries a uniform surface charge σ. **4**

g) Show that the electric field E is the gradient of scalar potential V ie. $E = -\nabla V$ and find the potential inside an outside a spherical hell of radius r which carries uniform surface charge. **8**

Either :

2. a) Derive the general solution for spherical coordinates of separation of variables. **8**

b) Find the potential inside the sphere, if $V_0(\Theta)$ is specified on the surface of a hollow sphere of radius R. **8**

OR

e) Explain the origin of coordinates in multipole expansions. **4**

f) Find the approximate potential at a point far from the dipole, if a electric dipole consist of two equal and apposite charges separated by a distance d. **4**

g) State and prove the Green's theorem. **8**

Either :

3. a) State and explain Biot Savart law. **4**

b) Find the magnetic field of a distances from a long straight wire carrying a steady current I. **8**

c) Deduce the differential form of Ampere's law. **4**

OR

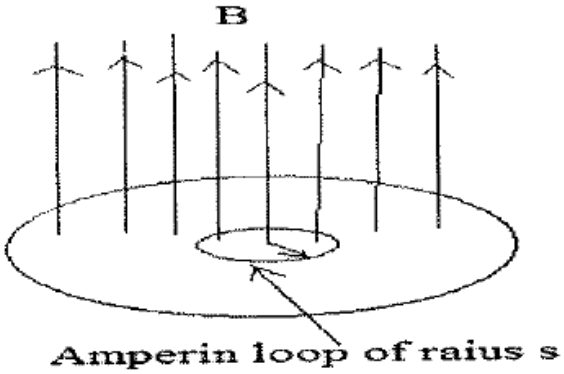
e) Derive the approximate formula for the vector potential of a localized current distribution. **8**

f) Explain the magnetostatic boundary condition by relating the current density j, the field B and the potential A. **8**

Either :

4. a) Deuce the differential an integral form of Faradays law. **4**

b) A uniform magnetic field B, pointing straight up, fills the shade circular region as shown in figure. If B is changing with time what is the induced electric field? **4**



c) Explain the formulation of Maxwell's equation in matter. **8**

OR

e) Derive the continuity equation. **4**

f) State and prove Poynting theorem, give its differential form and hence define Poynting vector. **8**

g) Explain Gauge transformation. **4**

5. a) Derive Poisson's equation and Laplace's equation. **4**

b) Explain boundary conditions and uniqueness theorems in short and state the first and second uniqueness theorems. **4**

c) Explain in brief magnetic vector potential. **4**

d) Deduce the differential formulation for conservation of momentum. **4**

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