

M.Sc.(Physics) (CBCS Pattern) Semester - I  
**PSCPHYT04 - Core Paper-IV : Electrodynamics-I**

P. Pages : 2

Time : Three Hours



**GUG/S/23/11182**

Max. Marks : 80

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**Either:**

1. a) State and explain Gauss law and write its differential form. 6  
b) State and explain coulomb's law in vector form. 4  
c) Derive an expression for electrostatic potential energy. 6

**OR**

- e) Discuss Dirac Delta function and its properties. 8  
f) What is Coulomb's law and explain it for continuous charge distribution. 8

**Either:**

2. a) State and prove first and second uniqueness theorem. 8  
b) Write the Laplace equation in spherical polar co-ordinates. Assuming the potential  $v$  is independent of  $\phi$ . Solve the equation by variable separation and show that

$$V(r, \theta) = \sum_{\ell=0}^{\infty} \left( A_{\ell} r^{\ell} + \frac{B_{\ell}}{r^{\ell+1}} \right) P_{\ell}(\cos \theta)$$

**OR**

- e) What is Green's theorem? Discuss applications of green theorem. 8  
f) Discuss the method of separation of variables in Cartesian co-ordinates. 8

**Either:**

3. a) Define vector potential A. show that if the divergence of A is zero then the vector potential satisfies the Poisson equation, also give the solution of Poisson equation. 8  
b) Find the divergence and curl of magnetic field B in case of volume current. 8

**OR**

- e) Find the magnetic field inside and outside the solenoid consisting of n closely wound turns per unit length on a cylinder of radius R and carrying a steady current I. 8  
f) Explain magnetostatic boundary conditions. 8

**Either:**

4. a) State Faraday's Law of electromagnetic induction and give the integral form and differential form of the law. **8**
- b) State and prove Poynting theorem. **8**

**OR**

- e) Derive Maxwell's equation in matter. **8**
- f) Give physical significance of Maxwell's equation and derive integral form of Maxwell's equation. **8**
5. Explain the followings:
- a) Derive Poisson's and Laplace's equation. **4**
- b) Discuss method of image for classical image problem. **4**
- c) Show that the magnetic field is given by curl of a vector potential. **4**
- d) "The electric field does not remain conservative when the magnetic field varies with time." from this statement. **4**

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