

Exam. Code : 103201

Subject Code : 1266

B.A./B.Sc. 1st Semester

PHYSICS

Paper—B

(Electricity & Magnetism)

Time Allowed—3 Hours] [Maximum Marks—35

Note :— Attempt *five* questions, selecting at least *one* question from each section. The **fifth** question may be attempted from any section.

SECTION—A

1. (a) State and prove Gauss theorem. 5
(b) Using Gauss theorem, calculate the total charge enclosed by a closed surface if the number of lines of force entering is 15000 and that emerging out from it is 25000. 2
2. (a) What is meant by gradient of a scalar quantity? Give its physical interpretation. 5
(b) Find $\bar{\nabla} \phi$ where $\phi = x^2 + y^2 - 2z^2$ at the point (1, 2, 1). 2

SECTION—B

3. (a) Derive the expression $\bar{E} = -\bar{\nabla}V$. What is the significance of negative sign? 4
(b) The potential distribution in space is given by $V = 3x + 4y - z$. Show that electric field is uniform everywhere and find its value. 3

4. (a) Show that electric potential due to a dipole varies inversely as a square of the distance. 5
(b) What is meant by electric multipoles ? 2

SECTION—C

5. (a) Derive the expression equation of continuity
$$\vec{\nabla} \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$$
 where \vec{J} and ρ are current densities and charge densities respectively. Also derive the expression for steady currents. 5
(b) Derive the expression for macroscopic form of Ohm's law. 2
6. (a) Derive the Ohm's law from $\vec{J} = \sigma \vec{E}$. 4
(b) What is ohmic and non-ohmic devices ? Discuss any two devices which belong to category of non-ohmic. 3

SECTION—D

7. (a) What is meant by free and bound currents ? 2
(b) Derive the expression for :
(i) Differential form of Ampere's law for magnetic materials. 2.5
(ii) Integral form of Ampere's law of magnetic materials. 2.5
8. Explain diamagnetism on the basis of orbital motion of electrons and derive the magnetic moment. 7