

This question paper contains 3 printed pages]

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S. No. of Question Paper : 6956

Unique Paper Code : 222565

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Name of the Paper : Physics—III Electricity, Magnetism and  
Electromagnetic Theory (PHPT404)

Name of the Course : B.Sc. (APS-Industrial Chemistry/Analytical Chemistry)

Semester : V

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *Five* questions in all. Question No. 1 is compulsory.

Attempt any other *four* questions from the rest of

the paper. *All* questions carry equal marks.

1. Attempt any *five* :

(a) The electric potential is given by :

$$V = 3x^2y + 4xz.$$

Calculate the electric field.

(b) Write the *four* boundary conditions for E,B,D, H. Give the statement also.

(c) For an EM wave  $E = \cos(6 \times 10^7 t - kz) \hat{i}$ . Find out the value of  $k$ .

(d) What is an equipotential surface ? Write the definition of 1 volt.

(e) Define the displacement current.

P.T.O.

- (f) Starting from the integral form of Gauss's law, obtain the differential form.
- (g) In free space, derive the wave equation with the help of Maxwell's equations.
- (h) Show that magnetic force does not do any work. 5×3=15
2. (a) Using Biot-Savart's law prove  $\text{div } \mathbf{B} = 0$ . Discuss the physical meaning of  $\text{div } \mathbf{B} = 0$ . 9
- (b) Prove that the force on a point charge moving with velocity  $v$  in a magnetic field  $\mathbf{B}$  is given by : 6
- $$\mathbf{F} = q(\mathbf{v} \times \mathbf{B}).$$
3. (a) What is Ballistic galvanometer ? Give the working principle and construction. Define its current sensitivity and charge sensitivity. Find out the relation between them. 12
- (b) What is damping ? 3
4. (a) Find the magnetic field at any point on the axis of a circular coil carrying current  $i$ . 8
- (b) Describe the direction and magnitude of the force experienced by two parallel current carrying wires due to each other, when the current is in the same direction and in the opposite direction. 7
5. (a) Define self and mutual inductance. 4
- (b) With the help of Ampere's law find the magnetic field inside a solenoid. 7
- (c) A solenoid is wound with a coil of 200 turns. The coil is carrying a current of 15 amperes, Find the value of magnetic intensity, when the length of the coil is 80 cm. 4

6. (a) What is polarization? Describe linearly, circularly and elliptically polarized electromagnetic wave and draw the patterns for a phase delay of  $0, \pi/4, \pi/2, \pi, 3\pi/2, 2\pi$ . 9
- (b) Show that electromagnetic waves are transverse in nature. 6
7. (a) Derive an expression for the potential energy for a group of point charges. 8
- (b) Find the expression for the potential at a distance 'z' on the axis passing through the center of a uniformly charged circular disc of radius 'r'. 7
8. (a) With the help of Gauss law find the strength of electric field at any point inside, outside and on the surface of the sphere of radius, having a charge Q. 9
- (b) Find the electric field at a distance 'r' above the midpoint of a straight line of length 2L, which carries a uniform line charge density  $\lambda$ . 6