This question paper contains **3** printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **89**

Unique Paper Code : **222565** **G**

Name of the Paper : **Physics—III (Electricity, Magnetism and Electromagnetism)**

(PHPT-404)

Name of the Course : **B.Sc. Industrial 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.

1. Attempt any *five* :

   (*a*) Define self-inductance of circuit. What are its units ?

   (*b*) Using Ampere's law calculate field due to a long solenoid.

   (*c*) Prove reciprocity theorem for mutual inductance i.e. $M_{12} = M_{21}$.

   (*d*) What are the charge sensitivity and current sensitivity of Ballistic galvanometer ?

   (*e*) What is the physical significance of $\vec{D}$.

   (*f*) Define volume and surface charge densities.

   (*g*) Show the work done in moving a charge from one point to another in an electrostatic field is path independent. 3×5

P.T.O.

2. (*a*) State and prove Gauss's theorem for electrostatics.

(*b*) Using Gauss's law calculate the electric field due to an infinite line charge having a linear charge density λ. 7,8

3. (*a*) What is an equipotential surface ? Show that equipotential surface cut lines of force at right angle.

(*b*) Calculate the field and potential of a spherical charge distribution. 3,12

4. (*a*) State Bio-Savart's Law (or Laplace's law). Using Laplace's Law (or Bio-Savart's Law) calculate magnetic field due to a coil of radius *a* carrying a current *i* :

(*i*) at the centre

(*ii*) at the axis of the coil.

(*b*) Prove $\vec{\nabla} . \vec{B} = 0$, explain its physical significance. 12,3

5. (*a*) Obtain an equation of motion of a moving coil Ballistic Galvanometre including the various effects of a damping. State the condition under which behaviour of the coil is :

(*i*) dead beat

(*ii*) oscillatory

(*iii*) critically damped.

(*b*) State Ampere's circuital theorem (Ampere's law) in integral form and hence derive its differential form $\vec{\nabla} \times \vec{B} = \mu_0 \vec{j}$. 10,5

6. (*a*) State Faraday's law of electromagnetic induction and prove :

$$\vec{\nabla} \times \vec{E} = \frac{-\partial \vec{B}}{\partial t}.$$

(*b*) Write down the *four* Maxwell's equation in a linear isotropic, homogeneous, dielectric medium and explain their physical significance. Discuss how Maxwell modified Ampere's Law to make it consistent with equation of continuity. 7,8

7. (*a*) Derive electromagnetic wave equation in free space, using Maxwell's equation. Find the expression for velocity of the wave in free space.

(*b*) Describe how circularly polarized and elliptically polarized wave can be produced from unpolarized light wave. 10,5