

5. Write short notes on the following :

- (a) Dielectric Medium 4
- (b) Polarization 4
- (c) Bound Charge 4
- (d) Electric Displacement. 4

Unit III

6. Write an expression for Biot-Savart law and hence find the magnetic field a distance z above the centre of the circular loop of radius R , which carries a steady current I . 16

7. (a) Find the magnetic field a distance s from a long straight wire carrying a steady current I . 4

(b) Define magnetic vector potential. Show that magnetic vector potential :

$$A(r) = \frac{\mu_0}{4\pi} \int \frac{J(r')}{r} d\tau',$$

where $J(r')$ is current density at r . 12

Roll No.

Exam Code : J-21

Subject Code—52500

B. Sc. EXAMINATION

(Main/Re-appear) (Batch 2018 Onwards)

(First Semester)

PHYSICS

CPL-103

Electricity and Magnetism—I

Time : 3 Hours

Maximum Marks : 80

Note : Attempt *Five* questions in all. Q. No. 1 is compulsory. Use of simple calculator is allowed.

1. (a) Define electric flux and what is its SI unit. 2

(b) Why electric lines of force do not cross each other ? 2

- (c) What do you understand by conservative field ? Write *two* examples of conservative field. 2
- (d) What is displacement current ? Where does it flow ? 2
- (e) Explain why magnetic monopole does not exist. 2
- (f) A neutron is moving parallel to direction of magnetic field. Then what is the force experienced by it. 2
- (g) What do you mean by Bohr Magneton ? What is its value ? 2
- (h) What is retentivity and coercivity ? 2

Unit I

2. (a) What is Gauss law in electrostatic ? Give its differential form. 8
- (b) Find the gradient of $r = \sqrt{x^2 + y^2 + z^2}$ (magnitude of the position vector). 8

3. (a) What is electric potential ? Find the potential of uniformly charged spherical shell of radius R. 10
- (b) Three charges are situated at the corner of a square of side “a”. How much work does it take to bring in another charge, +q, from far away and place it in the fourth corner. 6

Unit II

4. (a) Write an expression for Gauss's theorem in dielectrics and hence show that : 8

$$\oint \mathbf{D} \cdot d\mathbf{a} = Q_f$$

where Q_f is free charge.

- (b) A long straight wire, carrying uniform line charge λ , is surrounded by rubber insulation out to a radius a . Find the electric displacement ? 8

Unit IV

8. (a) Derive an expression for the force acting on a magnetic dipole in an external field. How does the direction of force differ in paramagnetic and diamagnetic substance ?

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- (b) The magnetic susceptibility of Bi is $-2.12 \times 10^{-11} \text{ Nm}^{-1}$. Calculate relative permeability.

4

9. (a) What is meant by free and bound currents ? Prove the relation $\mathbf{J}_{\text{bound}} = \nabla \times \mathbf{B}$.

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- (b) An infinitely long circular cylinder carries a uniform magnetisation $\mathbf{M}$ parallel to its axis. Find the magnetic field inside and outside the cylinder.

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