

Roll No.20057

Exam Code : D-22

Subject Code—58380

B.Sc. EXAMINATION

(Main/Reappear) (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. Attempt *four* more questions selecting *one* question from each Unit. Make diagrams in support of your answer wherever necessary.

1. (a) Write total charge in the form of surface charge distribution and volume charge distribution.

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P.T.O.

- (b) Give physical significance of the divergence of electrostatic field.
- (c) What are polar and non-polar dielectrics ?
- (d) Give physical significance of dielectric constant.
- (e) Differentiate between electrostatics and magnetostatics.
- (f) Give physical significance of the curl of magnetic field.
- (g) Define the term 'intensity of magnetization'.
- (h) Why there is loss of energy in hysteresis loop ? $2 \times 8 = 16$

Unit I

2. (a) Define electric field due to a line charge, surface charge and volume charge.

- (b) Find the electric field above the mid-point of a straight-line segment of length $2L$, which carries a uniform line charge λ .
- (c) Define electric flux. State and prove Gauss's law in differential form. 5,5,6
3. (a) Derive the relationship between electric field and potential.
- (b) Find an expression for energy stored due to a point charge distribution.
- (c) Show that potential difference between two points a and b is equal to the workdone per unit charge required to carry a particle from a to b . 5,5,6

Unit II

4. (a) Electrostatics is the study of Laplace's equation. Comment.
- (b) Show with the help of diagrams how the potential varies for monopoles, dipoles, quadrupoles and octopoles.

- (c) Derive an expression for multi-pole expansion of potential due to an arbitrary localized charge distribution. **5,5,6**

5. (a) Define the following terms :

- (i) Dielectrics
- (ii) Induced dipoles
- (iii) Atomic polarizability.

(b) Explain Gauss's law in presence of dielectrics. What is electric displacement ?

(c) Define relative permittivity and electric susceptibility. Derive the relationship between them. **5,5,6**

Unit III

6. (a) Explain the origin of magnetic field and magnetic force. Explain Lorentz force law.

(b) Magnetic force do no work. Comment. Define magnetic vector potential.

- (c) Use Ampere's law to find the magnetic field of a very long solenoid consisting of n closely wound turns per unit length on a cylinder of radius R and carrying a steady current. 5,5,6

7. (a) As Coulomb's law plays role in electrostatics, Biot-Savart's law plays in magnetostatics. Comment.
- (b) Find the magnetic field at a point P on the axis of a current carrying solenoid.
- (c) Prove that the divergence of the magnetic field is zero. 5,5,6

Unit IV

8. (a) What are Bound Currents ? Give their physical interpretation.
- (b) State and explain Ampere's law for magnetised materials.
- (c) Define magnetic susceptibility, magnetic permeability and auxiliary field. 5,5,6

9. (a) Differentiate between diamagnetic, paramagnetic and ferromagnetic substances.
- (b) Explain domain theory of ferromagnetism.
- (c) What is B-H curve ? Discuss its significance.

5,5,6