K24U 2760

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2024
(2019 to 2022 Admissions)
CORE COURSE IN PHYSICS
5B07PHY : Electrostatics and Magnetostatics

Time : 3 Hours Max. Marks : 40

PART – A

Short answer questions. Answer **all** questions. **Each** carries **1** mark.

1. Write down the relation between electrostatic field and electric potential in integral and differential form.
2. Write down the equation for the work done to move a charge Q through a potential difference V.
3. Give the equation for magnetic Lorentz force and explain the symbols.
4. Give the expression for the magnetic dipole moment of a current loop.
5. Give any two properties of diamagnetic material.
6. What is meant by Curie temperature of a ferromagnetic material ? **(6×1=6)**

PART – B

Short essay questions. Answer **any six** questions. **Each** carries **2** marks.

7. Derive the expression for the electrostatic potential due to a point charge q.
8. Show that the normal component of electric field is discontinuous across a surface charge density.

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9. Derive an expression for the electrostatic work done to assemble a collection of three point charges from infinite separation.

10. What is meant by atomic polarizability ? Give its SI unit.

11. What is meant by polar and non-polar molecules ? Give an example for each.

12. Explain electric susceptibility, permittivity and dielectric constant of a linear dielectric material.

13. What is meant by magnetization M ? Define bound volume current density and bound surface current density. Give their SI units.

14. Discuss the boundary conditions of the magnetostatic fields. **(6×2=12)**

PART – C

Problems. Answer **any four** questions. **Each** carries **3** marks.

15. Find the electric field at a distance z above the midpoint of a straight line segment of length 2L which carries a uniform line charge λ.

16. A student gives the electrostatic field in a region as $\mathbf{E} = k[xy\hat{x} + 2yz\hat{y} + 3xz\hat{z}]$ V/m. Is this a possible field ? Why ?

17. Find the capacitance of two concentric spherical metal shells with radii a and b.

18. Derive the expression for the net force on an electric dipole placed in a non-uniform electric field.

19. Find the magnetic vector potential inside an infinite solenoid with turns per unit length n, radius r and current I.

20. Show that the energy of a magnetic dipole of moment m in a magnetic field B is given by U = –m.B. **(4×3=12)**

PART – D

Long essay questions. Answer **any two** questions. **Each** carries **5** marks.

21. Explain Gauss's law. Obtain the differential form of Gauss's law. Use the law to determine the electric field outside a uniformly charged solid sphere of radius R and total charge q.

22. Show that the electric potential and hence the field due to a polarized object is the same as that produced by a volume bound charge density and a surface bound charge density.

23. Discuss the cycloid motion of a charged particle in a combined electrostatic and magnetostatic fields.

24. Discuss the effect of a magnetic field on atomic orbits. Explain how diamagnetism arises from this effect. **(2×5=10)**

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