K25P 3562

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (C.B.C.S.S. – OBE-Reg./Supple./Imp.) Examination, October 2025
(2023 Admission Onwards)
Physics/Physics with Computational and Nano Science Specialization
MSPHN01C03/MSPHY01C03 : ELECTRODYNAMICS

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any 5**, **each** question carries **3** marks. **(5×3=15)**

1. Show that Laplace's equation has no local maxima or minima, using one dimensional case.
2. Determine magnetic field due to a uniform current / passing through an infinite cylindrical conductor of circular cross section (both inside and outside the cylinder).
3. A conducting disc is held perpendicular to a magnetic field and is rotated with constant angular velocity. Determine the emf produced.
4. The potential $V_0(\theta)$ is specified on the surface of a hollow sphere, of radius R. Find the potential inside the sphere.
5. What are four-vectors ? Write down Lorenz transformation in matrix form ?
6. Derive wave equation for conducting medium. Discuss the nature of propagation in conducting medium.

SECTION – B

Answer **any 3, each** question carries **6** marks. **(3×6=18)**

7. Calculate electric field and potential of a system of a thick conducting spherical shell of inner and outer radii a and b, (a < b), where a point charge q is placed at the centre.

P.T.O.

8. Define scalar and vector potentials. Rewrite Maxwell's equations using scalar and vector potentials.

9. For a long ideal solenoid, derive the field inside using Ampère's law and explain what happens to the field outside.

10. Derive the Poynting vector and interpret the energy flow in an electromagnetic wave.

11. Derive Snell's law of refraction.

SECTION – C

Answer **any 3, each** question carries **9** marks. **(3×9=27)**

12. Two charges +q and –2q are placed at (0, 0, 3d) and (0, 0, d) respectively. Assume that XY plane is a grounded conductor. Determine (a) the electrostatic potential at $z > 0$, (b) force acting on the charge q, and (c) energy of the configuration.

13. What are free charges and bound charges ? Rewrite Maxwell equations in material medium using free charges. Also derive the boundary conditions for fields between different media.

14. What is a waveguide ? Discuss the propagation of TE modes in a rectangular waveguide.

15. Discuss electric dipole radiation and derive expression for the Poynting vector, intensity and total power radiated.

16. What is meant by radiation reaction ? Derive Abraham -Lorentz formula. **(3+6)**

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