K24P 3918

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (C.B.C.S.S. – O.B.E. – Reg./Supple./Imp.) Examination, October 2024
(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. State and prove first uniqueness theorem.
2. Draw the electromagnetic wave polarized in the z direction and propagates in the x direction.
3. Explain the concept skin depth.
4. Explain the origin of radiative reaction force.
5. What is meant by radiation ? Why static fields cannot produce radiation ?
6. Show that Current density 4 vector is divergence less.

SECTION – B

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

7. Using method of images find the potential at a point $z > 0$ due to a point charge placed on the z axis $z > 0$ in presence of an infinite grounded conducting sheet on the X-Y plane ($z = 0$).
8. Show that when an EM wave pass through a conductor its electric and magnetic fields won't be in same phase.

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9. A rectangular wave guide with dimensions 2.28×1.01 cm^2 is given. What TE mode will propagate in this wave guide, if the driving frequency is 1.70×10^{10} Hz ?
10. An electron is released from rest and falls under the influence of gravity. In the first centimeter, what fraction of the potential energy is radiated away ?
11. Write on electromagnetic field tensor and dual tensor. Express Maxwell's equations in Covariant form.

SECTION – C

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

12. Explain the method of solving Laplace equation for a potential, having azimuthal symmetry [$V = V(r, \theta)$], in spherical polar coordinates.
13. Explain the fundamental laws of geometrical optics. Derive Fresnel's equations for the case of polarization in the plane of incidence. Obtain the expressions for the reflection and transmission coefficients.
14. Obtain the intensity of electric field and magnetic field at a point in the radiation zone emitted from an oscillating electric dipole.
15. Explain radiation reaction. Derive Abraham-Lorentz formula.
16. Prove that the space interval $x^2 + y^2 + z^2$ is not invariant under Lorentz transformation, while the combined space time interval $x^2 + y^2 + z^2 - c^2t^2$ is Lorentz invariant. Draw and explain Minkowski diagram.

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