

QP CODE: 19002392



Reg No :

Name :

M.Sc. DEGREE (C.S.S) EXAMINATION, NOVEMBER 2019

First Semester

Faculty of Science

PHYSICS

Core - PH010103 - ELECTRODYNAMICS

2019 Admission Onwards

E7FAA040

Time: 3 Hours

Maximum Weight :30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. What is electric displacement?
2. What is the significance of vector potential A in magnetostatics?
3. Show that the bound surface current $K_b = M \times \hat{n}$.
4. Write down the Cauchy's formula and obtain the physical dimension of Cauchy's constants.
5. Describe retarded potentials.
6. List the approximations used in obtaining the power radiated by an oscillating electric dipole and explain the physical basis of these approximations.
7. Explain the disturbing implications of Abraham-Lorentz formula for radiation reaction.
8. Explain, what is meant by a four vector.
9. Describe the transformation properties of Minkowski force K^μ under Lorentz transformation.
10. Write down the electromagnetic field tensor and the dual tensor.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. A point charge q is situated a distance a from the center of a grounded conducting sphere of radius R . Find the potential outside the sphere.





12. An infinitely long straight wire carries a slowly varying current $I(t)$. Determine the induced electric field as a function of distance r from the wire?
13. Consider EM wave in free space of the form $\vec{E}(x, y, z, t) = \vec{E}_0(x, y)e^{i(kz - \omega t)}$ and $\vec{B}(x, y, z, t) = \vec{B}_0(x, y)e^{i(kz - \omega t)}$. Find the relation between k and ω . Find also the relation between E_0 and B_0 . Show that E_0 and B_0 satisfy the free space Maxwell's equations.
14. What is the attenuation distance for a plane wave propagating in a good conductor? Express the result in terms of conductivity σ and frequency ω .
15. For a point charge moving in a specified trajectory $w(t)$, compute ∇t_r .
16. An electron is released from rest and falls under the influence of gravity. In the first centimeter, what fraction of the potential energy lost is radiated away?
17. Define the four acceleration $\alpha^\mu = \frac{d\eta^\mu}{d\tau}$. Write the components α^0 and α in terms of u and a (ordinary velocity and acceleration).
18. The lowest frequency of the electromagnetic field that can propagate through a rectangular waveguide is 3 MHz. Find the dimensions of the waveguide.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. In the static case, show that the electromagnetic force on the charge configuration can be expressed only in terms of stress tensor at the boundary.
20. 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.
21. Discuss the potential formulation in electrodynamics. Using Coulomb and Lorentz gauge express Maxwell's equations in terms of potentials.
22. Illustrate that magnetism naturally arise if one treats electrostatics in the relativistic framework.

(2×5=10 weightage)

