

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2019 – 2020 & thereafter)

M.Sc., DEGREE EXAMINATION NOVEMBER 2023
PHYSICS
THIRD SEMESTER

COURSE : MAJOR CORE

PAPER : ELECTRODYNAMICS

SUBJECT CODE : 19PH/PC/ED34

TIME : 3 HOURS

MAX. MARKS : 100

SECTION - A

ANSWER ALL QUESTIONS:

(10x3=30)

1. Explain the concept of the electric scalar potential and how it relates to the electric field.
2. State uniqueness theorem and mention its significance.
3. What is the relation between energy and momentum of an electromagnetic wave?
4. What is skin depth?
5. Explain electromagnetic field tensor.
6. Write the expressions for Lagrangian and Hamiltonian for a charged particle in an electromagnetic field.
7. Calculate the maximum electric field in an electromagnetic radiation in free space when maximum magnetic field is 1.5×10^{-4} T.
8. What is the Larmor formula? Briefly describe the physical quantities it calculates in the context of electromagnetic radiation.
9. Mention the difference between wave and group velocities.
10. Write a note on magnetic diffusion.

SECTION – B

ANSWER ANY FIVE QUESTIONS:

(5x5=25)

11. Derive the expression for the energy associated with a continuous charge distribution and its significance in electrostatics.
12. What is Gauge transformation? Brief on Coulomb and Lorentz gauge.
13. Explain covariant form of Maxwell's equations.
14. Compare and contrast the electric dipole radiation and magnetic dipole radiation.
15. Mention the essential conditions for guided waves.
16. Write brief note on attenuation in waveguides.
17. Discuss about magnetic potential at any point due to current carrying elements.

SECTION – C

ANSWER ANY THREE QUESTIONS:

(3x15=45)

18. (i) Explain in detail the multipole expansion of the vector potential
(ii) Obtain the equation for magnetic field due to magnetic dipole.
19. Describe the propagation of electromagnetic wave in linear media and thus obtain, (i) Fresnel's equation and (ii) Brewster's angle
20. Discuss about the relativistic Lagrangian for a free particle in terms of (i) energy and (ii) momentum.
21. Explain for a moving point charge, (i) Lienard-Wiechert potentials and (ii) electric and magnetic fields.
22. Discuss the TE and TM waves in a rectangular wave guide and obtain expressions for cut-off frequency and wavelength.
