STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2019 – 2020 & thereafter)
SUBJECT CODE : 19PH/PC/ED34

M.Sc., DEGREE EXAMINATION NOVEMBER 2022
PHYSICS
THIRD SEMESTER

COURSE : MAJOR CORE
PAPER : ELECTRODYNAMICS
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION - A

ANSWER ALL QUESTIONS: **(10x3=30)**

1. State uniqueness theorems.
2. Prove that $\vec{\nabla} \cdot \vec{B} = 0$.
3. What is the limitation of Ampere's law? How is it overcome by Maxwell?
4. Comment on skin depth.
5. What are four vectors?
6. Obtain the electromagnetic field tensor.
7. An infinite straight wire carries the current $I(t) = \begin{cases} 0, & for\ t \leq 0 \\ I_0, for & t > 0 \end{cases}$. Find the resulting electric field.
8. Write down the Lienard- Wiechert potentials for a moving point charge and explain the terms associated with it.
9. State the essential conditions for guided waves.
10. What are cavity resonators?

SECTION – B

ANSWER ANY FIVE QUESTIONS: **(5x5=25)**

11. Find the electric field intensity at a distance z above the midpoint of a straight line segment of length 2L, which carries a uniform line charge λ.
12. How does the concept of magnetic vector potential arise? And obtain an expression for the same.
13. Explain the phenomena of reflection and transmission of electromagnetic waves at normal incidence.
14. State and prove Poynting's theorem.
15. Show that Maxwell's equations are invariant under Lorentz transfomation.
16. Derive the Abraham – Lorentz formula for the radiation reaction force.
17. Obtain the magnetohydrodynamic equations.

SECTION – C

ANSWER ANY THREE QUESTIONS: **(3x15=45)**

18. a) Determine the electric potential at a point due to a localized charge distribution. (7 marks)
    b) Find the potential of a uniformly charged spherical shell of radius R. (8 marks)
19. Discuss the phenomenon of dispersion in non-conductors and thereby arrive at Cauchy's equation.
20. Obtain the relativistic Lagrangian and Hamiltonian for a charged particle moving in an electromagnetic field.
21. Prove that the total power radiated by an oscillating magnetic dipole is directly proportional to the fourth power of the frequency.
22. Discuss the propagation of TE and TM waves in a rectangular wave guide.

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