LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **PHYSICS**

FIRST SEMESTER – **NOVEMBER 2013**

PH 1818 - ELECTRODYNAMICS

Date : 08/11/2013 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

PART - A

Answer **ALL** questions (10 x 2 = 20)

1. Establish Ampere law in differential and integral form.
2. A long cylinder carries a charge density that is proportional to the distance from the axis $\rho = ks$ for some constant k. Find the electric field inside the cylinder.
3. State Poynting's theorem.
4. What is a gauge transformation? Give an example.
5. What do you mean by time like interval?
6. State the Einstein velocity addition rule.
7. What are retarded potentials?
8. Give the Larmor formula for power radiated by a point charge.
9. What are the boundary conditions on **E** and **B** for a wave guide?
10. Why TEM mode is not possible in a hollow waveguide?

PART - B

Answer any **FOUR** questions (4 x 7.5 = 30)

11. Find the general solution to Laplace's equation in spherical coordinates when V depends only on **r**. Also obtain the general solution to Laplace's equation in cylindrical coordinates when V depends only on **s**.
12. Derive expressions for energy density and momentum of electromagnetic waves.
13. Establish that the relativistic energy is non-zero even when the object is stationary.
14. Calculate the radiation damping of a charged particle attached to a spring of natural frequency ω_0 driven at frequency ω.
15. Explain how a coaxial transmission line supports propagation of TEM waves.

PART - C

Answer any **FOUR** questions (4 x 12.5 = 50)

16. State and prove first and second uniqueness theorems.
17. Derive an expression for Maxwell's stress tensor and hence establish the conservation of momentum in electrodynamics.
18. Obtain the transformation equations among the components of electric and magnetic fields.
19. Obtain Leinard-Wiechert potentials for a moving point charge.
20. What are waveguides? Obtain expressions for the longitudinal components E_z and B_z.

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