LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

FIRST SEMESTER – APRIL 2014

PH 1818 - ELECTRODYNAMICS

Date : 02/04/2014   Dept. No.   Max. : 100 Marks
Time : 09:00-12:00

PART A

Answer **ALL** the questions   ($10 \times 2 = 20$)

1. State first and second uniqueness theorems.
2. Establish Ampere law in differential and integral form.
3. Define the term 'Polarization' and 'Polarization angle'.
4. State Poynting's theorem.
5. What is meant by light like interval?
6. What is a gauge transformation? Give an example.
7. Define radiation zone.
8. Explain the term retarded potentials.
9. What are the boundary conditions on **E** and **B** for a wave guide?
10. What is cut-off frequency with reference to a waveguide?

PART – B

Answer any **FOUR** questions   ($4 \times 7.5 = 30$)

11. Find the field outside a uniformly charged solid sphere of radius R and charge q.
12. Derive expressions for the energy and momentum of electromagnetic waves.
13. Derive an expression for energy-momentum four vector and hence establish the Einstein's relativistic expression for energy.
14. Arrive at Abraham-Lorentz formula for the radiation reaction force.
15. Show that a coaxial transmission line support TEM waves.

PART – C

Answer any **FOUR** questions   ($4 \times 12.5 = 50$)

16. Outline the theory of multipole expansion of electrostatic potential in powers of $\frac{1}{r}$.
17. Derive an expression for Maxwell's stress tensor and hence establish the conservation of momentum in electrodynamics.
18. Combine the electric and magnetic field in to a single entity the Field tensor $F^{\mu\nu}$.
19. Find the retarded potentials V(**r**, t) and A(**r**, t) of a point charge moving with constant velocity.

20. What are waveguides? Obtain expressions for the longitudinal components E_z and B_z in both the TE and TM modes of propagation in a rectangular waveguide.

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