LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FIRST SEMESTER – **NOVEMBER 2018**

16/17/18PPH1MC02 – ELECTRODYNAMICS

Date: 27-10-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART A

Answer **ALL** questions: 10 x 2 = 20 marks

1. Two large metal plates, each of area A and charge Q are held a distance d apart what is the electrostatic pressure on the plate?
2. Electrostatic energy does not obey superposition principle. Explain.
3. A phonograph record of radius R, carrying a uniform surface charge σ, is rotating at a constant angular velocity ω. Find its magnetic dipole moment.
4. Determine the constant **c** such that the vector F = (x+ay)i+(y+bz)j+(x+cz)k will be solenoidal.
5. Event A happens at point (X_A=5, Y_A=3, Z_A=0) and at time t_A given by (ct_A=15). Event B occurs at (10, 8, 0) at ct_B=5. Both in system S. Find the invariant interval between A & B.
6. State Work- Energy Theorem.
7. Explain the term retarded potentials.
8. Give the Larmor formula for the power radiated by a non-relativistic point charge.
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 x 7.5 = 30 marks

11. Find the potential and electric field intensity for the region between two concentric right circular cylinders, where V=0 at r_a=1mm and V=100 V at r_b=20mm
12. Calculate the power flow for a plane wave using the Poynting theorem.
13. Find the velocity that an electron must be given so that its momentum is $10m_oc$,where m_o is the rest mass. Also find the energy of the electron.
14. An infinite straight wire carries a current I(t) = 0 (for t ≤ 0) and I(t) = I_0 (for t > 0). Find the resulting electric and magnetic fields.
15. Show that a coaxial transmission line of inner and outer radius a and b respectively admit waves with E_z = 0 and B_z = 0.

16. State Larmor Formula. (b) Suppose an electron decelerated at a constant rate **a** from some initial velocity v_0 down to zero. What fraction of its initial kinetic energy is lost to radiation? (assume $v_0 << c$) (2.5 + 5).

PART C

Answer any **FOUR** questions: 4 x 12.5 = 50 marks

17. Outline the theory of multipole expansion of electrostatic potential in powers of (1/r).
18. What is Gauge transformation? Explain in detail Coulomb Gauge and Lorentz Gauge.
19. From the Lorentz transformation equations arrive at Einstein velocity addition rule. Calculate the percentage contraction of a rod moving with a velocity 0.8c in the direction inclined 60° to its own length (6.5+6).
20. Obtain Leinard-Wiechert potentials for a moving point charge.
21. What are waveguides? Obtain expression for the longitudinal component B_z in TE mode of propagation in a rectangular waveguide.
22. Prove the uniqueness theorems in electrostatics.

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