



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - PHYSICS

FIRST SEMESTER – APRIL 2013

PH 1812 - ELECTRODYNAMICS

Date : 27/04/2013
Time : 9:00 - 12:00

Dept. No.

Max. : 100 Marks

SECTION -A

Answer **all** the questions:

10 x 2 = 20

1. Electrostatic energy does not obey superposition principle. Explain.
2. What is the relation between dielectric constant and susceptibility for a linear dielectric?
3. Use Ampere's law to find the magnetic potential at any point due to an infinitely long straight conductor.
4. Distinguish between dia, para and ferro magnetic materials.
5. Explain the term 'displacement current'.
6. What is a gauge transformation? Give an example.
7. Write down the boundary condition on E across an interface between two dielectric media.
8. Define skin depth.
9. Explain the term 'retarded potentials'.
10. What do you mean by velocity and acceleration fields?

SECTION -B

Answer any **four** questions:

4 x 7.5 = 30

11. The electric potential of some configuration is given by the expression $V(\mathbf{r}) = A \left(\frac{e^{-\lambda r}}{r} \right)$ where A and λ are constants. Find the electric field $\mathbf{E}(\mathbf{r})$, the charge density $\rho(r)$ and the total charge Q.
12. Evaluate $\nabla \times \vec{B}$ for a general volume current distribution with current density \vec{j} .
13. Obtain Maxwell's equations in matter.
14. Explain the phenomena of reflection at a conducting surface using suitable boundary conditions on the Maxwell's equations.
15. Obtain Leinard-Wiechert potentials for a moving point charge.

SECTION -C

Answer any **four** questions:

4 x 12.5 = 50.

16. (a) Derive an expression for the energy of a charge distribution. (6)
(b) Establish Gauss's law in the presence of a dielectric. (6.5)
17. (a) Derive an expression for the magnetic potential using multi pole expansion. (10)
(b) Find the boundary conditions on **B** across an interface. (2.5)
18. State and prove Poynting's theorem.
19. Derive an expression for complex dielectric constant and hence explain the phenomena of anomalous dispersion. Establish Cauchy's formula relating the coefficient of refraction and coefficient of dispersion.
20. Assuming Lienard-Weichert potentials, calculate the electric and magnetic fields of a moving point charge.
