

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

FIRST SEMESTER – NOVEMBER 2007

PH 1807 - ELECTRODYNAMICS

AC 14

Date : 25/10/2007

Dept. No.

Max. : 100 Marks

Time : 1:00 - 4:00

PART A

Answer **all** the questions

10 X 2 = 20

1. State the principle of superposition
2. Define the terms electric susceptibility and dielectric constant
3. Write down the expressions for the magnetic force due to volume current and surface current
4. What is linear media?
5. A uniform magnetic field B is directing upwards. Find the expression for induced electric field if B is changing with time
6. What is motional e.m.f.?
7. What is Brewster's angle?
8. An electromagnetic wave enters in three different media of refractive indices n_1, n_2 and n_3 . The angles of incidence in those media being $\theta_1, \theta_2, \theta_3$. Write down the modified Snell's relation.
9. Is charge density Lorentz invariant. Explain?
10. Explain the origin of radiation reaction force on a moving charged particle

PART B

Answer **any four** questions

4 X 7.5 = 30

11. Obtain the differential and integral forms of Gauss's law in electrostatics
12. Show that $i) \nabla \times \vec{B} = \mu_0 \vec{J}$ $ii) \nabla \cdot \vec{B} = 0$
13. Prove that Mutual inductance between pairs of coils is purely a geometrical quantity
14. Derive the expressions for energy density and momentum of electromagnetic waves in free space
15. Obtain the expression of retarded scalar and vector potentials

PART C

Answer **any four** questions

4 X 12.5 = 50

16. Prove that i) $\oint \vec{D} \cdot d\vec{a} = Q_{\text{enclosed}}$ ii) A sphere of linear dielectric material is placed in an uniform electric field. Find the expression for the modified electric field inside the sphere
17. Obtain an expression of multipole expansion of magnetic vector potential and derive the expression of magnetic dipole moment
18. Explain the potential formulation of electrodynamics to bring out the importance of gauge transformations with specific reference to Coulomb and Lorentz gauges
19. Discuss in detail the phenomena of refraction and transmission of electromagnetic wave which is obliquely incident at the boundary of two linear media. Calculate the expression for transmittance and reflectance
20. Give the theory of magnetic dipole radiation to obtain an expression for power radiated.
