



B.E./B.Tech(Full Time) DEGREE END SEMESTER EXAMINATIONS NOV./DEC. 2012
COLLEGE OF ENGINEERING GUINDY CAMPUS, ANNA UNIVERSITY, CHENNAI
ELECTRICAL AND ELECTRONICS ENGINEERING BRANCH
THIRD SEMESTER
EE 9202: Electro Magnetic Theory
(Regulations 2008)

Time: 3 Hours

Max. Marks: 100

Answer ALL questions
PART – A (10 x 2 = 20 Marks)

1. Give the differential displacement and volume in spherical co-ordinate system?
2. Prove that $\nabla \cdot \bar{r} = 3$ where \bar{r} is the position vector of any point P in space?
3. Dielectric polarization is a boom. Justify.
4. Can field exist in a perfectly conducting medium? Justify your answer.
5. Find the electric potential at origin when three equal point charges, $Q = 10\text{nC}$ are located at 4, 5, 6m.
6. A circular coil of radius 8cm is made up of 200 turns. It carries a current of 5A. Compute the magnetic field intensity at the centre of the coil.
7. Define magnetic susceptibility.
8. What is the maximum torque on a square loop of 1000 turns in a field intensity of 1 tesla.
9. List the practical applications of electromagnetic waves.
10. Find the velocity of a plane wave in a lossless medium having a relative permittivity of 4 and a relative permeability of 1.2.

PART – B (5 x 16 = 80 Marks)

11. a. Obtain an expression for electrostatic potential energy and energy density for a group of point charges in a static field. (10 Marks)
b. State and prove electrostatic boundary conditions. (6 Marks)
12. a. (i) A thin annular disc of inner radius 'a' and outer radius 'b' carries a uniform surface charge density ρ_s . Determine the electric field intensity, flux density and potential at any point on Z axis. (12 Marks)
(ii) A novel printing technique is based upon electrostatic deflection principle? Justify. (4 Marks)
(OR)
b. (i) Show that over the closed surface of a sphere of radius 'b', $\oint \bar{D} \cdot d\bar{s} = 0$. (4 Marks)
(ii) Verify the divergence theorem for a Vector field $\bar{D} = 3x^2 \bar{a}_x + (3y + z) \bar{a}_y + (3z - x) \bar{a}_z$ in the region bounded by the cylinder $x^2 + y^2 = 9$ and the planes $x=0, y=0, z=0$ and $z=2$ (12 Marks)

13. a. (i) Explain the significance of Magnetic Vector Potential and thus obtain an expression for the magnetic flux Φ from the same. **(12 Marks)**

(ii) Compare the Different magnetic materials with their applications. **(4 Marks)**

(OR)

- b. Obtain an expression for the inductance of a long solenoid with 'N' number of turns. What will be the inductance if the same coil is made a toroid? **(16 Marks)**

14. a. Obtain an expression for the H in an infinitely long co-axial Transmission line and thus plot H_ϕ against ρ **(16 marks)**

(OR)

- b. Obtain the set of Maxwell's equation for free space in both Integral and Differential form from the fundamental laws **(16 Marks)**

15. a. (i) Explain clearly the generation of electromagnetic waves and thus obtain an expression for a plane wave in free space. **(12 Marks)**

(ii) A parallel plate capacitor with plate area of 3 cm^2 and plate separation of 1.5 mm has a voltage $50 \sin 10^3 t \text{ V}$ applied to its plate. Calculate the displacement current assuming $\epsilon = 2\epsilon_0$. **(4 Marks)**

(OR)

- b. (i) Calculate ϵ_r , ω and E , in a loss less dielectric for which $\eta = 60\pi$, $\mu_r = 1$ and $H = -0.1 \cos(\omega t - z) \bar{a}_x + 0.5 \sin(\omega t - z) \bar{a}_y \text{ A/m}$. **(6 Marks)**

(ii) Obtain an expression for the Power density vector associated with electromagnetic fields at a given point **(10 Marks)**
