ANNA UNIVERSITY COIMBATORE

B.E. / B.Tech. DEGREE EXAMINATIONS – DECEMBER 2008

THIRD SEMESTER – ELECTRICAL & ELECTRONICS ENGG.

EE 303 - ELECTROMAGNETIC THEORY

Time: Three Hours **Maximum: 100 Marks**

PART A – (20 x 2 = 40 marks)

Answer ALL questions

1. Given $\vec{A} = 10\vec{a}_x + 3\vec{a}_z$ and $\vec{B} = 5\vec{a}_x + 4\vec{a}_y$ Find the projection of $\vec{A}$ on $\vec{B}$
2. Determine the divergence of the given vector field at specified points.

   $\overline{B}$ = ρZ sin ϕ $\overline{a_\rho}$ + 3ρZ^2 cosϕ $\overline{a_\phi}$ at (5, $\pi/2$, 1)
3. Given the potential field v = 2x^{2}y – 5z at a point P (–4, 3, 6), find the potential V.
4. What are dipoles?
5. Write the difference between conduction current and displacement current.
6. Give Poission's and Laplace's equations
7. Calculate the energy stored in a 10μF capacitor which has been charged to a voltage of 400 V.
8. Write the expression for a capacitance of an isolated spherical conductor
9. A conductor 1.5 m long carries a current of 50 A at right angles to a magnetic field of intensity 1.2 T. Calculate the force on the conductor.
10. Define the terms magnetic moment and magnetic permeability?
11. Write Gauss Law for magnetic fields.
12. What is the expression for the torque experienced by a current carrying loop placed in a magnetic field?
13. Define self inductance and mutual inductance
14. Calculate the inductance of a ring shaped coil having a mean diameter of 20 cm. Wound on a wooden core of 2 cm diameter. The winding is uniformly distributed and contains 200 turns.
15. State Faraday's Law of Electro magnetic induction with a mathematical expression.
16. A conductor of length 0.5 m moves is a uniform magnetic field of density 2.2 T at a velocity of 30 m/s. Calculate the induced voltage in the conductor when the direction of motion is perpendicular to the field.
17. Define skin depth what is it for good conductors?
18. Find the velocity of a plane wave in a loss less medium having a relative permittivity of 5 and relative permeability of 2
19. Define the term intrinsic impedance of free space with its value.
20. What is Poynting vector?

PART - B (5 x 12 = 60 Marks)

Answer Any FIVE Questions

21.(a) State and explain Coulomb's law of electro static force (4)

(b) A 2mc positive charge is located in vacuum at P_1 (3, –2, – 4) and a 5 μc negative charge in at P_2 (1, – 4, 2). Find the force on the negative charge. (8)

22.(a) Verify the divergence theorem for the following case. $A = xy^2 \vec{a}_x + y^3 \vec{a}_y + y^2z \vec{a}_z$ and the surface is a cuboid defined by $0 < x < 1$, $0 < y < 1$ and $0 < z < 1$ (6)

(b) Derive an expression for potential at a point due to dipole (6)

23. Derive electric boundary conditions for a dielectric to dielectric medium and conductor to dielectric medium (12)

24.(a) Derive an expression for force between two long straight parallel current carrying conductors (8)

(b) Find the force length between two long, straight parallel conductors carrying a current of 10A in the same direction. A distance of 0.2 m separates the conductors. (4)

25. Derive an expression for self inductance of a two wire transmission line (12)

26. Derive from the fundamentals, all the four Maxwell's equations in differential and integral form (12)

27. Obtain the expression for magnetic field intensity due to an infinite sheet of charge placed with its centre at origin, at a point P (0,0,n) Extend the same for finite sheet of charge (12)

28. State and prove Poynting theorem and also derive Average power (12)

*********THE END*********