B.E. DEGREE EXAMINATIONS: APRIL / MAY 2010

Fourth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U07EC403: Electromagnetic Fields

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

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following is zero?

   a. curl grad   b. div grad   c. grad div   d. curl curl

2. Point charges Q1= 1nC and Q2 = 2nC are at a distance apart. Which of the following statement is incorrect?

   a. The force on Q1 is repulsive.

   b. The force on Q2 is the same in magnitude as that on Q1.

   c. As the distance between them decreases, the force on Q1 increases linearly.

   d. Q1 and Q2 experience no net charge.

3. Gauss law is used to find _____.

   a. E and D for symmetrical charge distribution

   b. E and D for unsymmetrical charge distribution

   c. B and H for symmetrical charge distribution

   d. B and H for unsymmetrical charge distribution

4. The unit of magnetic charge is _____

   a. Ampere/meter   b. Coulomb   c. Ampere   d. Ampere-meter

5. The point form of continuity equation is _____.

   a. $\nabla . \vec{J} = -\frac{\partial \rho_v}{\partial t}$ b. $\nabla \times \vec{J} = -\frac{\partial \rho_v}{\partial t}$ c. $\nabla . \vec{J} = \frac{\partial \rho_v}{\partial t}$ d. $\nabla \times \vec{J} = \frac{\partial \rho_v}{\partial t}$

6. The magnetic moment is defined as the product of _____ and _____ of a loop.

   a. Current, area   b. Voltage, area   c. Power, area   d. Power, distance

7. One of the Maxwell's equation for good conductor is _____.

   a. $\nabla . \vec{D} = \rho$ b. $\nabla . \vec{D} = 0$ c. $\nabla . \vec{D} = -\frac{\partial \vec{H}}{\partial t}$ d. $\nabla . \vec{D} = -\frac{\partial \vec{B}}{\partial t}$

8. $\nabla \times \vec{H} = (\sigma + j\omega\varepsilon) \vec{E}$ is the point form of _____.

   a. Static field   b. Time varying field c. Harmonically varying field d. Dynamic field

9. The magnitude of the ratio of conduction current density to displacement current density is called as _____.

   a. Charge density   b. Loss Tangent   c. Current density   d. Convection current

10. The distance at which the EM wave gets attenuated to 37.7% of the original amplitude is called _____.

   a. Attenuation constant   b. Skin depth   c. Propagation constant   d. Phase constant

PART B (10 x 2 =20 Marks)

11. State the relation between Cartesian and spherical co-ordinate systems.

12. Define Surface and Volume Charge densities.

13. Write Lorentz force equation. Give applications for the same.

14. Explain the terms Magnetic Torque and Magnetic Moment.

15. Calculate the inductance of a solenoid, 8 cm in length, 2 cm in radius, having μ_r =100 and carrying 900 turns of wire.

16. Write the expression for capacitance of spherical capacitor.

17. Define Poynting vector.

18. Write Maxwell's equations in phasor form.

19. Define Loss tangent.

20. Write the condition for polarization of a sinusoidal wave.

PART C (5 x 14 =70 Marks)

21. (a) Obtain an expression for an electric field due to infinite line charge having density ρ_l C/m placed along z-axis at a point P on Y-axis at a distance of d from the Z-axis.

(OR)

  (b) (i) State and prove Gauss Law   (6)

    (ii) Derive the expressions for Electric field intensity and Electric Potential due to a dipole.   (8)

22. (a) (i) State and prove Ampere's circuital law.   (6)

    (ii) Write any one application of Ampere's circuital law.   (8)

(OR)

  (b) Find the magnetic flux density at a point on the axis of circular loop that carries a direct current I and hence find the magnetic flux density at the centre of the circular loop.

23. (a) (i) Derive the boundary relations at the boundary between two different magnetic materials. (10)

(ii) An air core toroid has a mean radius of 60mm and is wound with 6000 turns of wire. The circular cross section of the toroid has a radius of 6 mm. The current of 10A is passed in the wire. Find the inductance and the energy stored. (4)

(OR)

(b) Derive the expression for Capacitance between two concentric conducting spheres using Laplace equation.

24. (a) (i) Derive Modified form of Ampere's Circuital law in integral form and in point form.(10)

(ii) A radio station transmits power radially around the spherical region. The desired Electric Field Intensity at distance of 10 Km from the station is 1 mV/m. Calculate the corresponding Magnetic field, power density and the power transmitted by the station. (4)

(OR)

(b) (i) Discuss about power flow in co-axial cable. (8)

(ii) In a material for which $\sigma = 4$ S/m and $\varepsilon_r = 1$, the electric field intensity is $E = 300 \sin 10^{10} t \ V/m$. Find J_C, J_D and frequency at which both have equal magnitudes. (6)

25. (a) (i) Derive wave equation in phasor form. (8)

(ii) Explain the types of polarization. (6)

(OR)

(b) Derive the expression for reflection coefficient when a wave is incident obliquely on a perfect dielectric.

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