Register No: …….

**B.E DEGREE EXAMINATIONS: APRIL/MAY 2011**

Fourth Semester

**ELECTRONICS AND COMMUNICATION ENGINEERING**

U07EC403: Electromagnetic Fields

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

**Answer ALL Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. The unit of permittivity is

   a) Fm b) $Fm^{-1}$ W c) $F^{-1}m$ d) $Fm^2$

2. The relationship between Electric field intensity and Electric field density is

   a) $\vec{D} = \epsilon\vec{E}$ b) $\vec{D} = \vec{E} / \epsilon$ c) $E^2 \epsilon$ d) $\epsilon^2 E$

3. In the equation $\vec{E} = -\nabla V$, the negative sign indicates that $\vec{E}$ and movement of the charge of the both are

   a) Perpendicular to each other b) both in the same direction

   c) both in the opposite direction d) at standstill

4. According to divergence Theorem $\nabla . \vec{D}$ is equal to

   a) Volume charge density b) charge density c) surface charge density d) Linear charge

5. Microwave oven is working on the principle of

   a) Poisson's equation b) Laplace equation c) Polarization d) Faraday's Law

6. According to point form of Ohm's Law

   a) $\vec{J} = \rho\vec{E}$ b) $\vec{J} = \sigma\vec{E}$ c) $\vec{J} = I\vec{A}$ d) $\vec{J} = \mu\vec{E}$

7. If current is acting along Z axis mean, then the magnetic intensity will act along

   a) X axis b) Y axis c) Φ axis d) Z axis

8. The unit for P in pointing vector $P = \vec{E} \times \vec{H}$ is

   a)Watts b)watts/$m^2$ c) watts - $m^2$ d) watts hour

9. The value of intrinsic impedance is

   a) $\sqrt{\mu/\epsilon}$ b) $\sqrt{\epsilon/\mu}$ c) $\mu / \epsilon$ d) $\epsilon / \mu$

10. Apply 300MHZ wave propagating through fresh water. it is a lossless medium Neglecting attenuation at this time. Given $\mu_r = 1, \epsilon_r = 78$ .Find propagation constant

    a) 55.5 rad/m b) 5.55 rad/m c) 55 m d) 55 rad

**PART B (10 x 2 = 20 Marks)**

11. State Coulomb's law of force between any two charges.

12. Define Dipole
13. Find the force experienced by electrons when it moves at a velocity of 200 m/sec at right angles to uniform magnetic field of one tesla and give the formula for Lorenz force.
14. Write down the expression for the magnetic scalar and vector potential.
15. Find the Laplacien equation of the potential factor $V = x^2+y^2+z^2$
16. State the boundary conditions between the two different magnetic materials
17. Write down the expression for average power flow and average poynting vector
18. State Faraday's Law
19. Find the skin depth at a frequency of 2 MHz in Aluminum if $\sigma = 38.2$ MS/m and $\mu_r = 1$
20. What is the Brewster angle?

**PART C (5 x 14 = 70 Marks)**

21. a) (i) Let a charge magnitude $Q_1 = -10^{-2}$ C be placed at P (2, 1, 3) and a charge $Q_2 = 3 * 10^{-4}$ C be placed at Q (4, 1, 2) calculate the force acting by $Q_1$ on Q2 (7)

(ii) Three point charges $Q_1 = -10^{-6}$ C , $Q_2 = 10^{-6}$ C, $Q_3 = 0.5 * -10^{-6}$ C are placed in free space at three corners of an equilateral triangle of 5 cm length. Find the Magnitude and direction of the forces on $Q_3$ (7)

**[OR]**

b) Define curl of vector field. What is the physical definition of the curl of a Vector field? State and prove divergence Theorem

22. a) (i) Using Biot-Savart's law find magnetic field intensity at the centre of a circular Conductor carrying current of I Amp (7)

(ii) Calculate the magnetic flux density due to circular coil of 100 ampere turns and area of 70 $cm^2$ on the axis of the coil at a distance of 10 cm from the centre (7)

**[OR]**

b) (i) Find magnetic field intensity on the axis of a circular conductor, the point p is located at a distance z from the plane of circular loop along z axis (7)

(ii) Find an expression for torque acting on a square loop carrying a current of I Amp (7)

23. a) (i) Derive the energy and energy density of the static electric field (7)

(ii) Derive the conditions at a boundary between dielectrics in the electric field which have permittivities $\epsilon_1$ and $\epsilon_2$ (7)

**[OR]**

b) (i) The combined inductance of two coils connected in series is 0.6 H (or) 0.1 H depending on the relative directions of current in the coil. If one of the coil when isolated has self inductance of 0.2 H, calculate (i) the mutual inductance and (ii) the coupling coefficient (7)

(ii) Derive an expression to determine the capacitance between two concentric Spherical shells (7)

24. a) Derive the Maxwell's equations in both differential form and integral form.

**[OR]**

b) Discuss the Poynting Vector and Poynting Theorem.

25. a) (i) A uniform plane wave in a medium having $\sigma = 10^{-3}$ s/m , $\epsilon = 80\ \epsilon_o$ and $\mu = \mu_o$ is having a frequency of 10 KHz. Calculate the different parameters of the wave (10)

(ii) Explain Normal incidence of uniform plane wave on Lossless media (4)

**[OR]**

b) (i) A normally incident electric field has amplitude E = 1 V/m in free space just outside the sea water in which $\epsilon_r = 80$ ; $\mu_r = 1$ , $\sigma = 2.5$ s/m . For a frequency 300 MHz at what depth the amplitude of E be 1 mv/m (7)

(ii) Using ampere's circuital law, find magnetic field intensity due to a coaxial cable carrying current I (7)

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