Register Number: ……..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Third Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE104: Electromagnetic Fields

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

Answer ALL Questions

PART A (10 x 1 = 10 Marks)

1. The Nature of Electric flux lines are
   a) Divergence b) Curl
   c) Both Divergence & Curl d) Rotational
2. The Vectors C = (-3ar + 2aθ + 1a□) and D = (5ar +6aθ + 3a□) are
   a) Parallel b) Perpendicular
   c) At an angle 35° d) Unrelated
3. The Electric flux density D is _____ direction to the Electric flux lines
   a) unrelated b) Tangential
   c) Normal d) Opposite
4. Divergence theorem relates the following two integrals
   a) Line integral to Volume Integral b) Volume integral to Surface Integral
   c) Surface integral to Line Integral d) Line integral to Surface integral
5. An Electron is placed at stationary position in an EM Field. What is the sequence of force given by fields acting on this particle?
   a) First H Field then E Field b) First E Field then H Field
   c) Both fields are acting simultaneously d) No force acting on the electron
6. When an Etan Component propagates from free space in to conducting medium then _____
   a) Etan = 0 b) Etan1 = Etan 2
   c) Etan1 = E norm d) Etan 1 = - Etan 2
7. Maxwell inserted the expression for displacement current J_D in
   a) Gauss Law b) Amperes law for Time varying case
   c) Faradays Law d) Equation of Continuity
8. In EM Wave the Electric field in Z direction and Magnetic Field in Y direction. Find the wave propagating direction.
   a) X Direction b) – Y Direction

   c) – X Direction d) – Z Direction
9. Skin Depth is defined as the distance travelled by the wave in a conducting medium at which its amplitude falls to _____of its value.
   a) $1/e^2$ b) 38%
   c) 36.8% d) 37%
10. The value of $\nabla \cdot (\nabla X A) =$ _____
    a) $\nabla X(\nabla \cdot A)$ b) 0
    c) $\nabla X(\nabla A)$ d) $\nabla \cdot A$

Answer ALL Questions

PART B (10 x 2 = 20 Marks)

11. Find the gradient of scalar system $t = x^2y + e^z$ at point P(1,5,-2)
12. A charge of 2 x 10^{-7} is acted upon by a force of 0.1N. Determine the distance to the other charge of 4.5 x 10^{-7}. Both the charges in vacuum.
13. A uniform line charge ρl = 25nC/m lies on the line X = -3m and Y = 4m in free space. Find Electric Field intensity at a point (2, 3, 15) m.
14. Write the equations expressing in Gauss law integral and differential form.
15. State biot Savarts Law.
16. Write the Lorentz force equation due to both electric and magnetic fields. mention its applications.
17. State the electric boundary conditions between two perfect dielectrics.
18. Find the displacement current density for the field E = 300 sin 100 ^{9} t (V/m)
19. A Uniform plane wave is travelling at a velocity of 2.5 x 105 m/s having wavelength λ = 0.25 in a good conductor. Calculate the conductivity of the medium.
20. Define Brewster Angle.

PART C (5 x 14 = 70 Marks)

21. a) (i). Given A = 4ay + 10 az and B = 2ax + 3ay. Find the projection of A on B. (4)

    (ii) Derive the Electric field intensity equation for a line of charge having infinite length (10)

(OR)

b) (i). Point Charge $Q_1 = 300\mu C$, located at (1,-1,-3) m, Experiences force $F_1 = (8ax - 8ay + 4az)$ N due to point charge Q_2 at (3,-3,-2) m. Determine Q_2. (7)

(ii) The volume in cylindrical coordinates between r = 2 m and r = 4 m contains a uniform charge density $\rho(c/m^2)$. Use gauss law to find D in all regions. (7)

22. a) (i) Derive magnetic field intensity at any point on the axis of the circular ring. (8)

(ii) A Current Sheet K = 10az A/m, lies in the x = 5 m plane and a second sheet, K = -10 az A/m is at x = -5m. Find H at all Points (6)

(OR)

b) State and prove Stokes theorem.

23. a) (i). Derive the boundary relations for conductor dielectric interface. (9)

(ii) Calculate the inductance of solenoid of 200 turns wound tightly on a cylindrical tube of 6cm diameter. The length of the tube is 60cm and the solenoid is in air. (5)

(OR)

b) (i). Show that the inductance of the cable $L=\frac{\mu}{2\pi}\ln\frac{b}{a}H$. (7)

(ii) Obtain the expressions for the energy stored and energy density in a capacitor (7)

24. a) Obtain the expressions for the four Maxwell's equation in the point form and integral form

(OR)

b) (i). Discuss about Poynting vector and Pointing theorem. (8)

(ii) Given the conduction current density in a lossy dielectric as $Jc = 0.02 \sin 10^9 t$ A/m2. Find the displacement current density if $\sigma = 10^3$ mho/m and $\xi r = 6.5$. (6)

25. a) Derive E & H for normal incidence of a plane wave on a perfect conductor.

(OR)

b) Derive the components of perpendicularly polarized uniform plane wave.

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