Reg. No. _____

B.E./B.Tech. (FULL TIME) DEGREE EXAMINATION APRIL/MAY 2011

Third Semester

Electronics and Communication Engineering

EC271 –ELECTROMAGNETIC FIELDS AND WAVES

(Regulation: R-2004)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART -A (10x2=20 Marks)

1. Convert the points P(1,2 ,3), Q(1,-2,1) from Cartesian to cylindrical coordinates.

2. State Coulomb's law.

3. State Biot Savart's law.

4. The vector magnetic potential is given by $\mathbf{A} = -\cos(x)\cos(y)\,\mathbf{a}_z$. Find magnetic flux density vector (**B**) at origin.

5. What is the expression for energy density in terms of electric field vectors?

6. Determine the capacitance of parallel plate capacitor with separation distance d = 4 mm and area of plate is 20 cm^2. The relative permittivity of dielectric used in the capacitor is 6.

7. What is the difference between conduction current and displacement current density?

8. Given $\mathbf{E} = E_m \sin(\omega t - \beta z)\,\mathbf{a}_y$, in free space, Find magnetic flux density vector (**B**).

9. Define surface impedance.

10. A dielectric material has relative permittivity 18 and loss tangent 10^{-3} at 100 MHz. Find the conductivity of the medium.

PART B (5x16 = 80 marks)

11. i. State and explain the Gauss's law and derive the point form of it. (8)

ii. Three equal charges of 10×10^{-9} C are located at three corners of the rectangular object with size of 7x4 cm. Calculate the resultant electric field at vacant corner of the rectangular. Assume $\varepsilon = \varepsilon_o$. (8)

12.a.i. Find the magnetic flux density at a point on the axis of a circular loop of radius 'b' that carries direct current 'I'. (8)

ii. State and explain the Ampere's law of force and determine the force per unit length between two infinitely long parallel conducting wires carrying currents I_1 and I_2 in the same direction. The wires are separated by distance 'd'. (8)

(Or)

b.i. State and explain the Ampere's circuital law and derive the expression for point form. (8)

ii. An infinitely long solid conductor of radius 'a' is placed along 'z' axis. If the conductor carries current I in the +z direction, find the magnetic field intensity within the conductor. (8)

13.a.i. A spherical capacitor consist of an inner conducting sphere of radius 'R_i' and an outer conductor with a spherical inner wall of radius R_o. The space between is filled with a dielectric of permittivity 'ε'. Determine the capacitance. (8)

ii. Derive the Poisson and Laplace equations and explain its applications. (8)

(Or)

b.i. Find the inductance per unit length of a very long solenoid with air core having 'n' turns per unit length. (8)

ii. Derive the expression of energy stored in an inductor in terms of magnetic field quantities. (8)

14.a. Derive the boundary conditions between two different medium with parameters (ε_1, μ_1) and (ε_2, μ_2), when the electromagnetic field incident at the interface of two medium. (16)

(Or)

b.i. State Poynting's theorem and derive the expression for Poynting vector. (8)

ii. Derive the Maxwell's equations from Faraday's law of electromagnetic induction. (8)

15.a. Derive the wave equations from the Maxwell's equations and obtain the uniform plane wave solution. (16)

(Or)

b. Derive the expression for attenuation and phase constant, when uniform plane wave incident on good conductors and compare with perfect conductors. (16)
