Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, MAY 2014

Electronics and communication Engineering

III Semester

EC9201 Electromagnetic Fields and Waves

(Regulation 2008)

Time : 3 Hours Answer ALL Questions Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. State Gauss law. under what condition is Gauss's law especially useful in determining electric flux density of a charge distribution
2. Show that $\nabla.(\nabla V) = 0$
3. For $\mathbf{H} = 10\mathbf{a}_x+25\mathbf{a}_y-40\mathbf{a}_z$ A/m and $\mu=6.5\mu_o$, find the magnetic susceptibility χ_m of the material.
4. A small magnet placed at the origin produces $\mathbf{B} = -0.5\mathbf{a}_z$ mWb/m^2 at (10,0,0). Find **B** at (0,3,0) m.
5. In a copper wire, the conduction current is 2 A. Find the corresponding displacement current at 100 MHz. Assume for copper $\sigma=5.8\times10^7$ S/m.
6. Write the Maxwell's equation in integral form
7. Find the skin depth for the conductor with conductivity $\sigma=5.8\times10^7$ S/m. with the frequency of 1 GHz.
8. Consider the conductivity of the earth is $\sigma=10^{-2}$ mhos/m and $\varepsilon_r = 4$. Comment on the earth characteristics for the frequencies 1 KHz and 10 GHz.
9. What are the types of deflection on the CRO?
10. What is the difference between finite difference method and method of moments in solving the boundary value problems in electromagnetic.

Part – B (5 x 16 = 80 marks)

11. (i) Determine the capacitance for the coaxial capacitor of length 'L' with two coaxial conductors of inner radius 'a' and outer radius 'b' (b>a) .The gap between the conductors (a<r<b) is filled with permittivity ε. (8 Marks)
(ii) Derive the equation for the reflection coefficient of the uniform plane waves when it incident normally to the interface between two dielectrics. (8 Marks)

12. a) (i) Four point charges 1mC, 2mC, 3mC,4mC are located at the corners of the square in xy plane. The sides of the square are 1 cm. Find the force acted on the point charge of 10mc located at (0,0,5)meters. Find the electric filed intensity at that point. (10 Marks)

(ii) A dielectric sphere (ε_r=5.7) of radius 10 cm has a point charge 2 pC placed at its centre calculate the surface density of polarization charge on the surface of the sphere. (6 Marks)

(OR)

b) State and prove divergence theorem for $\mathbf{D}= 4\ x^3\mathbf{a}_x-2z\mathbf{a}_y-2y\mathbf{a}_z$, where the total charge lying within the region -1<x,y,z<1. (16 Marks)

13. a) (i) State and prove stokes theorem. (6 Marks)
(ii) The vector magnetic potential is given by $\mathbf{A}= -\rho^2/2\ \mathbf{a}_z$, Wb/m, calculate the total magnetic flux crossing the surface $\varphi=\pi/2$, $1 \le \rho \le 2$ m, $0 \le z \le 5$ m. (10 Marks)

(OR)

b) (i) Derive the Laplace and Poisson equation. State and prove the uniqueness theorem in the Laplace equation (8 Marks)
(ii) A circular loop located on $x^2+y^2=9$, z=0 carries a direct current of 10A along a_φ. Determine H at Biot Savart law at (0,0,4). (8 Marks)

14. a) Derive all the four Maxwell's equation from basic law's in point form and integral forms (16 Marks)

(OR)

b) (i) Derive the boundary condition for the electric and magnetic field intensity for the interface between the medium of conductor and dielectric. (10 Marks)
(ii) Explain the transformer Emf ,Motional Emf and combinational Emf. (6 Marks)

15. a) (i) Explain the working of the cyclotron which applies the static field concepts. (8 Marks)
(ii) explain how CRO exploits the electric and magnetic deflection properties (8 Marks)

(OR)

b) (i)Explain the procedure of calculating the finite geometry problems using the finite difference method. (8 Marks)

(ii) Given the one dimensional differential equation
$\frac{d^2y}{dx^2}=0$, $0 \le x \le 1$, subject to y(0)=0,y(1)=10, use the finite difference (iterative) method to find y(0.25) . Assume Δ=0.75 and perform 5 iterations. (8 Marks)