2004

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B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATION APRIL/MAY 2012

Electrical and Electronics Engineering

III Semester

EE 9202 Electromagnetic Theory

Time: 3 Hrs **Answer All Questions** **Max.Marks:100**

PART A (10 X 2 = 20)

1. List out the sources of various types of e.m.f.
2. Obtain in the cylindrical co-ordinate system the gradient of the function:
   $f(r,\theta,z)= 3r^4z^3 \sin\theta + \cos\theta + z^2$
3. Calculate the capacitance of a parallel-plate capacitor having an electrode area of 100 cm^2.the distance between the electrodes is 3 mm and the dielectric used has a permittivity of 3.The applied potential is 100V.Also compute the charge on the plates.
4. Write down the Laplace's and Poisson's Equations.
5. State Biot Savart's Law.
6. A solenoid 4 cm in length carries a current of 150 mA. If solenoid is to produce a magnetic flux density of 5 mWb/m^2. How many turns of wire are needed?
7. State : Faraday's law of Electromagnetic Induction
8. When can the non zero value of $d\Phi/dt$ may be obtained?
9. State: Poynting theorem.
10. Calculate the depth of penetration in copper at 2.5MHz, given the conductivity of copper $\sigma = 5.8X10^7$ S/m and its permeability = 1.2 μH/m.

PART- B (5 X 16 = 80)

11. a.i. Find the force on charge of q=100μC,placed at (0,0,3)meters, due to four like charges Q_1,Q_2,Q_3 and Q_4 of 20μC each placed on the x – and y- axes at $\pm$ 4m. [8]

    ii. Show that in Cartesian coordinates for any vector A, $\nabla.(\nabla^2 A)= \nabla^2(\nabla.A)$ [8]

12. a. Conducting spherical shells with radii a= 20 cm and b= 30cm are maintained at a potential difference of 200V such that V(r = b) = 0 and V = (r = a) =150V.Determine V and E in the region between the shells. If ε_r =3 in the region determine the total charge induced on the shells and the capacitance of the capacitor.[16]

(OR)

b. A sphere of radius 'a' is uniformly charged with a density $\rho C/m^3$.It is given that ρ is proportional to the radial distance 'r' from the centre. Obtain the expression for the electric field intensity E and potential V and plot the variation of both these functions with distance from the centre of the sphere.[16]

13.a.i.Consider the boundary between two media. Show that the angles between the normal to the boundary and the conductivities on either side of the boundary satisfy the relation:

$$\frac{\tan\theta_1}{\tan\theta_2} = \frac{\sigma_1}{\sigma_2}$$ [10]

ii) Write short notes about Classification of magnetic materials.(6)

(OR)

13.b.i Sate Ampere's circuital Law and Lorentz Law of Force.(6)

ii. A small current loop L_1 with magnetic moment $5a_z$ $A.m^2$ is located at the origin while another small loop current L_2 with magnetic moment $3a_y$ $A.m^2$ is located at (4, -2, 8). Determine the torque on L_2.(10)

14.a. Derive the Maxwell's differential and point form from Ampere's, Faraday's and Gauss's law.[16]

(OR)

b.i. Compare the field theory and circuit theory.[8]

ii. Find the amplitude of the displacement current density adjacent to an automobile antenna where the magnetic field intensity of n FM signal is H_x=0.15 Cos[3.12(3 X 10^8t-y)]A/m.[8]

15.a. A plane wave propagating through a medium with ε_r=7, μ_r=3 has $E = 0.5e^{-z/3} \sin(10^8t-\beta z)a_x$ V/m. Determine β,wave velocity, the loss tangent, H field, and intrinsic impedance.[16]

(OR)

15.b. In a free space ($z \leq 0$) a plane wave with H_i=15Cos(10^8t-βz)a_x mA/m. is incident normally on a lossless medium($\varepsilon = 2\varepsilon_o$, $\mu = 8\mu_o$) in region ($z \geq 0$).Determine the reflected wave H_r, E_r and the transmitted wave H_t, E_t.[16]

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