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10ES36

Third Semester B.E. Degree Examination, January 2013
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define 'Electric field intensity'. Derive an expression for electric field intensity' $(\bar{E})$ at a point due to many charges. **(07 Marks)**

b. Point charges of 50 nc each are located at A(1, 0, 0) B(-1, 0, 0) C(0, 10) and D(0, -1, 0)m, find the total force on the charge at A and also find $\vec{E}$ at A. **(05 Marks)**

c. Given $\vec{D} = 5\vec{ar}$ c/m^2, prove divergence theorem for a shell region enclosed by spherical surfaces at r = a and r =b (b > a) and centred at the origin. **(08 Marks)**

2 a. Find the electric field intensity at point x(1, 2, -1) given the potential $V = 3x^2y + 2y^2z + 3xyz$. **(05 Marks)**

b. Derive boundary conditions between conductor and free space if different 'ε'. **(08 Marks)**

c. Show that capacitance of co-axial cable is $C = \frac{2\pi \in L}{\ell_n[b/a]}F$ with usual notations. **(07 Marks)**

3 a. With usual representations derive Poisson's equation. **(05 Marks)**

b. Verify that the potential field given below satisfies the Laplace's equation $V = 2x^2 - 3y^2 + z^2$. **(05 Marks)**

c. A large spherical cloud of radius 'b' has a uniform volume charge distribution of ρ_v c/m^3, find the potential distribution and electric field intensity at any point in space using Laplace. **(10 Marks)**

4 a. State and explain Biot – Savart law. **(06 Marks)**

b. Calculate the value of vector current density in cylindrical co –ordinates at p(1.5, 90°, 0.5) if $\vec{H} = \frac{2}{\rho}\cos 0.2\phi \ \vec{a\phi}$. **(06 Marks)**

c. Given $\vec{H} = 20r^2 \vec{a\phi}$ A/m, determine the current density J also determine the total current that crosses the surface r = 1 m, $0 < \phi < 2\pi$ and z = 0 in cylindrical co-ordinate. **(08 Marks)**

PART – B

5 a. Derive lorentz force equation. **(05 Marks)**

b. Find the force per meter length between two long parallel wires separated by 10 cm in air and carrying a current of 10A in the same direction. **(05 Marks)**

c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6 cm diameter. The length of the tube is 60 cm, the solenoid is in air. Derive the equation for 'L'. **(10 Marks)**

6 a. Explain Maxwell's equations for time varying fields. **(10 Marks)**

b. Find amplitude of displacement current density (J_D) in the free space within a large power distribution transformer $\vec{H} = 10^6 \cos(377t + 1.2566 \times 10^6 z)\,\vec{ay}$ A/m. **(05 Marks)**

c. Given $H = H_m e^{j(\omega t+\beta z)}\vec{ax}$ A/m in free space find $\vec{E}$. **(05 Marks**

7 a. Starting from Maxwell's equations obtain the general wave equations in electric and magnetic field. **(10 Marks)**

b. A 300 MHz uniform plane wave propagates through fresh water for which $\sigma = 0$, $\mu_r = 1$, $\epsilon_r = 78$, calculate :

i) Attenuation constant
ii) Phase constant
iii) Wave length
iv) Intrinsic impedance. **(05 Marks)**

c. State and explain Poynting theorem. **(05 Marks)**

8 a. Define transmission co-efficient and reflection co-efficient deduce the relationship between them. **(06 Marks)**

b. A traveling $\vec{E}$ field in the free space of amplitude 100 v/m strikes a perfect dielectric as shown in Fig. Q8(b). Determine E_t. **(10 Marks)**

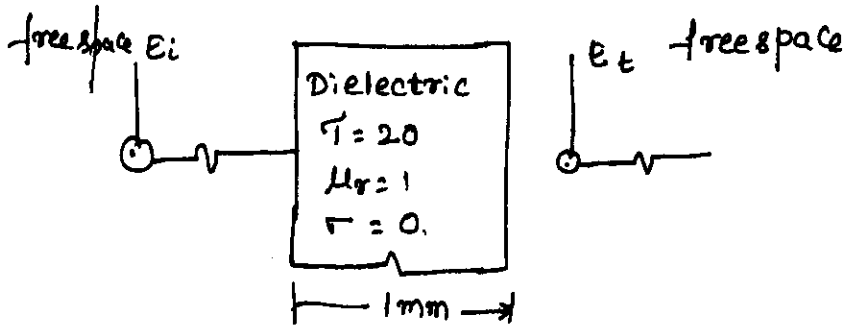

Fig. Q8(b)

c. Write a note on SWR. **(04 Marks)**

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