SE - ET - Sem-IV - old - E.N.T. 12/05/15

(OLD COURSE) **QP Code : 4146**

(3 Hours) **[Total Marks : 100**

1. Question no. 1 is compulsory.
2. Attempt any four questions from remaining six questions.
3. Figure to right indicate full marks.
4. Use suitable data, whenever necessary and justify the same.

1: Attempt any four

(a) State and explain Gauss's law. [05]

(b) Given the potential field, $V = 2x^2y - 5z$, and a point P(4,3,6), find the values at point P, i) The potential V, ii) The electric field intensity $\bar{E}$, iii) The electric field density $\bar{D}$, iv) The volume charge density ρ_v. [05]

(c) Ampere's circuital law.[05]

(d) Derive the dielectric-dielectric boundary condition for electrostatics field.[05]

(e) State and explain Biot Savart law. [05]

2. (a) Find the force on a point charge of $50\mu C$ at (0,0,5)m due to charge of $500\pi\mu C$ that is uniformly distributed over the circular disk $r \leq 5m, z = 0m$. [10]

(b) Explain depth of penetration (skin depth). Find the skin depth at frequency 1.6MHz in Aluminum whose $\sigma = 38.2mS/m$ and $\mu_r = 1$. Also find propagation constant and velocity in this medium (Assume $\alpha = \beta = 1/\delta$).[10]

3. (a) The magnetic field intensity is given in a certain region of space as, $\bar{H} = \frac{x+2y}{z^2}\bar{a}_y + \frac{2}{z}\bar{a}_z A/m$. i) Find $\nabla \times \bar{H}$, ii) find $\bar{J}$, iii) use $\bar{J}$ to find total current passing through the surface, $z = 4$, $1 \leq x \leq 2$, $3 \leq y \leq 5$ in the $\bar{a}_z$ direction, iv) Show that the same result is obtain using other side of Stoke's theorem. [10]

(b) State and explain Maxwell's equation in integral and differential form. [10]

4. (a) Derive Helmholtz's wave equation for electric field. [10]

(b) Let $\mu = 3\times10^{-5}H/m$, $\epsilon = 1.2\times10^{-10}F/m$, and $\sigma = 0$ everywhere. If $\bar{H} = 2cos\,(10^{10}t - \beta x)\,\bar{a}_z A/m$. Use Maxwell's equations to obtain expression for $\bar{B}, \bar{D}, \bar{E}$, and β.[10]

5. (a) Let the fields, $\bar{E} = 1800cos\,(10^7\pi t - \beta z)\,\bar{a}_x V/m$ and $\bar{H} = 3.8cos\,(10^7\pi t - \beta z)\,\bar{a}_y A/m$, represent uniform plane wave propagating at velocity of $1.4 \times 10^8 m/s$ in perfect dielectric. Find i) β, ii) λ, iii) η, iv) $\mu_r \& \epsilon_r$. [10]

(b) Define poynting vector and explain each term in its integral form. [10]

6. (a) Derive Laplace's and Poission's equation [10]

(b) Use laplace equation to find capacitance of coaxial cable of inner radius 'a' and outer radius 'b' meter, given $V = V_0$ at $r = a$ and $V = 0$ at $r = b$. [10]

7. Write short notes (any four)[20]
   (a) Image theory.
   (b) Wave impedance for free space.
   (c) Polarization in electromagnetic wave.
   (d) Magnetic vector potential.
   (e) Continuity equation.

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