TE - Sem-V (rBSCrS) Electrical - EMF and W   22/11/16
Electromagnetic Fields and Waves

Q.P. Code : 584002

(3 Hours)   **Total Marks : 80**

Note :(1) Question No. 1 is compulsory.
       (2) Answer **any three** from remaining Five questions.
       (3) Figures to right indicate Full marks.
       (4) Assume the data if it is necessary.

1. Attempt **any four** of the following :-   20
   a) Define gradient. Derive the relation between $\overline{E}$ and voltage gradient.

   b) If $\overline{A} = 10\hat{a}_r + 5\sin\theta \ \hat{a}_\theta$ then find $\nabla \cdot \overline{A}$

   c) If the magnetic field $\overline{H} = (3x\cos\beta + 6z\sin\alpha)\,\hat{a}_y$. Find the current density $\overline{J}$ if field are invariant with time.

   d) State and explain Amperes circuital law.

   e) Discuss various practical application of electrostatic field.

2. a) Derive an electric field intersity due to an infinite plane having density   10
   $\rho_s(C/m^2)$

   b) An electric flux density $\overline{D} = 2x\hat{a}_x + 3\hat{a}_y \ C/m^2$ 10

   Determine the net flux cressing the surface of a cube of 2m side and centered at origin, with edges parallel to the axes. Evaluate both side of divergence theorem.

3. a) A homogenous dielectric ($\varepsilon r_1 = 2.5$) fills the region 1 ($x \le 0$) while region 2   10

   ($x \ge 0$) is the free space. If $\overline{D}_1 = 12\hat{a}_x - 10\hat{a}_y + 4\hat{a}_z \ nC/m^2$ find out $\overline{D}_2$, $\overline{E}_2$, $\overline{E}_1$,
   θ_1, θ_2

   b) What is an electric dipole? Derive the expression of $\overline{E}$ and V due to an   10
   electric dipole.

4. a) Derive magnetic field intensity due to finite and infinite wire carrying a current I.   10
   b) Derive Poission's and Laplace equations. In spherical co ordinates V = -25 V   10
   on a conductor at r = 2 cm and V=150 V at r = 35 cm. The space between conductors is a dielectric for which $\varepsilon r = 3.12$. Find the surface charge densities on the conductors.

5. a) Derive the set of Maxwell's equation for static fields and time varying fields.   10
   b) Given $\overline{E} = Em\,Sin(wt - \beta z)\hat{a}_y$ in free space. Find $\overline{D}$, $\overline{B}$, $\overline{H}$ at Y =0.   10

   Also find the direction of β, $\overline{E}$, $\overline{H}$

270-1   **[TURN OVER]**

6. a) Derive an expression of wave equation in terms of time varying electric and   10
magnetic field.

   b) A medium has following parameters: 10

   $\mu_r = 10$, $\varepsilon_r = 2.5$, $\sigma = 10^{-4}$ mho/m Determine α, β, γ, Vp, λ for frequency of 1 GHz.

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