extra

QP Code : 31040

(3 Hours) [Total Marks: 80]

N.B.: (1) Question No.1 is **compulsory**.
    (2) Answer any **three** from remaining **five** questions.
    (3) Figures to the **right** indicate **full** marks.
    (4) Assume the **data** if it is **necessary**.
    (5) **Vector notation** must be **used** wherever **necessary**.

Q.1) Attempt any **four** of the following:- (05-Marks each)   [20]

   (a) Express the following vector in Cartesian co-ordinate system
     $\bar{A} = 2\cos\theta\ \hat{a}_r + 3r\ \hat{a}_\theta - 4\ \hat{a}_z$

   (b) Discuss the various practical applications of electrostatic fileds.

   (c) A $\bar{H}$ due to a current source is given by, $\bar{H} = [\,y\cos(\alpha x)\,]\ \hat{a}_x + [\,y + e^x\,]\hat{a}_z$. Describe the current density over the yz plane.

   (d) "Magnetic field has non-existance of monopole" Justify the statement.

   (e) Explain estimation and control of electric stress.

Q.2)   [20]

   (a) Derivation of E due to uniform volume charge density $\rho_v\ c/m^3$. Distributed in a sphere of radius 'a' centred at origin.   [10]

   (b) The flux density within the cylindrical volume bounded by $r = 4\ m$, $z = 0\ m$ and $z = 5\ m$, is given by $\bar{D} = 30\ e^{-r}\ \hat{a}_r - 2z\ \hat{a}_z\ c/m^2$. What is the total outward flux crossing the surface of cylinder?   [10]

Q.3)   [20]

   (a) A current sheet $\bar{K} = 10\ \hat{a}_z\ A/m$ lies in x=4 m plane and a second sheet $\bar{K} = -6\ \hat{a}_z\ A/m$ is at x=-5 m plane. Find $\bar{H}$ at points (i) $P(1,1,1)$ and (ii) $Q(0,-3,10)$ [10]

   (b) In the region $0 < r < 0.5\ m$ in cylindrical co-ordinates system, the current density is $\bar{J} = 4.5\ e^{-2r}\ \hat{a}_z\ A/m^2$ and $J = 0$ eleswhere. Use Ampere's Circuital Law to find H in all regions.   a2zSubjects.com   [10]

Q.4)   [20]

   (a) Derive the Poission's and Laplace equation. And determine whether the following potential fields satisfied Laplace equation or not?
    (i) $V = 4x^2 + 3y - 4z^2$ (ii) $V = r\sin\varphi + z$ [10]

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(b) Consider an interface in the Y-Z plane. The region $x < 0$ is medium-1 with $\mu_{r1} = 4.5$ and magnetic field, $\bar{H} = 4\,\hat{a}_x + 3\,\hat{a}_y - 6\,\hat{a}_z$ A/m. The region $x > 0$ is medium-2 with $\mu_{r2} = 6$. Find $\bar{H}_2$ and $\bar{B}_2$ in medium-2 and also calculate the angles made by the $\bar{H}_2$ with the normal to the interface.   [10]

Q.5)   [20]

(a) Show that following field vectors, in the free space,

$$\bar{E} = E_0 \cos(\omega t - \beta z)\,\hat{a}_x$$
$$\bar{H} = \frac{E_0}{\eta} \cos(\omega t - \beta z)\,\hat{a}_y$$

Can satisfy all Maxwell's equations provided that

$$\beta = \pm\,\omega\,\sqrt{\mu_0\,\varepsilon_0} \text{ and } \eta = \pm\,\sqrt{\frac{\mu_0}{\varepsilon_0}}$$ [10]

(b) State the Maxwell's equations for time varying fields in integral and point forms. Also explain the physical significance of each equation.   [10]

Q.6)   [20]

(a) Derive and explanation of the plane electromagnetic wave equation in free space and definition of wave velocity intrinsic impedance.   [10]

(b) A 9375 MHz uniform plane wave is propagating in polystyrene. If the amplitude of the electric field intensity is 20 $V/_m$ and the material is assume to be lossless. Find (i) the phase constant , (ii) the wavelength (in the polystyrene) , (iii) the velocity of propagation, (iv) the intrinsic impedance , (v) the propagation constant , (vi) the amplitude of the magnitude field intensity.   [10]

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