No. of Printed Pages : 3

BIEE-009

B.TECH. IN ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

December, 2013

BIEE-009 : APPLIED ELECTROMAGNETICS

00421

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks.*

1. Derive the expression for Divergence of $\overline{D}$ in Cartesian co-ordinate system. **10**

2. Given the points P($\rho = 5$, $\phi = 60°$, $Z = 2$) and Q($\rho = 2$, $\phi = 110°$, $Z = -1$); find **10**

(a) The distance $|\overline{R}_{PQ}|$;

(b) A unit vector in cartesian co-ordinates at P that is directed towards Q ;

(c) a unit vector in cylindrical coordinates at P that is directed towards Q ;

3. (a) Find the expression for potential difference V_{AB} in the field of a point charge. **5**

(b) Assume a zero reference at infinity and find the potential at P(0, 0, 10) that is caused by this charge configuration in free space: **5**

(i) 20 nC at the origin.

(ii) 10 nC/m along the line $x = 0$, $z = 0$, $-1 < y < 1$.

4. (a) Derive the continuity equation for current. 5

(b) Assume that an electron beam carries a total current of $-500\ \mu A$ in the $\bar{a}r$ direction, and has a current density J_z that is not a function of ρ or ϕ in the region $0 \leq \rho \leq 10^{-4}$ m and is zero for $\rho > 10^{-4}$ m. If the electron velocities are given by $V_z = 8 \times 10^7 z$ m/s, calculate ρ_v at $\rho = 0$ and $z =$ (i) 1mm ; (ii) 2 cm. 3+2=5

5. Find the incremental field $\Delta\bar{H}_2$ at P_2 caused by a source at P_1 of $I_1\ \Delta\bar{L}_1 =$ 10

(a) $2\pi\bar{a}_z\ \mu A.m$, given $P_1(4, 0, 0)$ and $P_2(0, 3, 0)$;

(b) $2\pi\bar{a}_z\ \mu A.m$, given $P_1(4, -2, 3)$ and $P_2(0, 3, 0)$;

6. Derive the point form of Ampere's Circuital Law. 10

7. Given $\bar{H} = y^2 z\,\bar{a}_x + 2(x+1)yz\bar{a}_y - (x+1)z^2\bar{a}_z$; find 4+2+4=10

(a) $\oint \bar{H} \cdot d\bar{L}$ around the square path going from P(0, 2, 0) to A(0, 2+b, 0) to B(0, 2+b, b) to C(0, 2, b) to P.

(b) Evaluate $\oint \bar{H} \cdot d\bar{L}$ for $b = 0.1$

(c) Find $\bar{\nabla} \times \bar{H}$.

8. Derive the magnetic boundary conditions. 10

9. (a) Derive wave equation for Electric Field Intensity. 6

(b) Define Frequency, Wavelength, Velocity and intrinsic impedance. 4

10. Write short notes (**any two**) : **5x2=10**

(a) Smith chart.

(b) SWR.

(c) Boundary conditions for perfect conductor.
