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BIEE-009

B.TECH. IN ELECTRICAL ENGINEERING (BTELVI)

01867

Term-End Examination

June, 2013

BIEE-009 : APPLIED ELECTROMAGNETICS

Time : 3 hours *Maximum Marks : 70*

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

1. Derive the expression for electric field intensity at any point due to a line charge with uniform line charge density ρ_L c/m on the infinitely long z - axis. 10

2. (a) Express the field $\bar{F} = 2xyz\ \bar{a}_x - 5(x+y+z)\bar{a}_z$ in cylindrical coordinates (variables and components). 7+3

   (b) Find $|\bar{F}|$ at p($\rho = 2$, $\phi = 60°$, $z = 3$)

3. (a) Derive the expression for potential difference V_{AB} in the field of a point charge located at origin. 5

   (b) A point charge of 6 nC is located at origin in free space. Find V_P if point p is located at p(0.2, -0.4, 0.4) and (i) $v = 0$ at infinity (ii) $v = 0$ at (1,0,0) 3+2

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 $\bar{a}_z$ direction, and has a current density Jz that is not a function of ρ or ϕ in the region $0 \leq \rho \leq 10^{-4}$m 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) 2cm 3+2

5. Find the vector magnetic field intensity in Cartesian coordinates at p_2 (1.5, 2, 3) caused by a current filament of 24A in the $\bar{a}_z$ direction on the z - axis and extending from : 10

(a) $z = 0$ to $z = 6$;

(b) $z = 6$ to $z = \infty$;

(c) $z = -\infty$ to $z = \infty$

6. Derive the expression for curl of $\bar{H}$. 10

7. For the finite length current element located on the z - axis between $z = z_1$ and $z = z_2$, using Biot -Savart Law show that 10

$$\bar{H} = \frac{1}{4\pi\rho} [\sin\alpha_2 - \sin\alpha_1] \bar{a}_\phi \text{ at a point } p(\rho, \phi, c)$$

where α_1 and α_2 are angles between p and z_1, and z_2 respectively.

8. Derive the magnetic boundary conditions. **10**

9. Derive Maxwell's equation for time - varying field from Faraday's law and Ampere's circuital law. **10**

10. Write short notes on ***any two*** of the following : **5x2=10**

(a) Poynting vector

(b) S.W.R.

(c) Boundary conditions for perfect dielectrics.
