PVP 14

Code: EC4T4

II B.Tech - II Semester – Regular Examinations – May 2016

ELECTROMAGNETIC FIELDS AND WAVES (ELECTRONICS AND COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) What are the ranges of cylindrical and spherical coordinates?
b) Write the significance of divergence and curl.
c) What are the features of Electric field intensity?
d) Determine E at origin due to uniform line charge distribution with ρ_l = 3.3nC/m located at x = 3m, y = 4m.
e) State Gauss law for electrostatic fields.
f) Write the expression for magnetic field intensity due to finite filamentary conductor carrying current 'I' in positive Z direction.
g) At a point P (x,y,z) the components A_x, A_y, A_z of vector magnetic potential A are given by $A_x = 4x + 3y + 2z$, $A_y = 5x + 6y + 3z$, $A_z = 2x + 3y + 5z$. Determine magnitude and direction of B at point A.
h) State Faraday law of Electromagnetic induction.

i) Write boundary conditions for Dielectric to Dielectric interface in case of electric and magnetic fields.

j) In free space Let E = 50 cos(10^8 t - β x) $\hat{a}_y$ V/m, Assume β is positive real constant. Find the direction of propagation and β.

k) In High loss medium, the EM wave is travelling in particular medium attains 2π rad of phase shift over 1m distance. What is skin depth?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2.

a) Derive the relationship between unit vectors of Cartesian coordinates and cylindrical coordinates . 6 M

b) Prove the divergence of curl of any vector is zero and curl of gradient of any scalar is zero . 4 M

c) Determine gradient and laplacian of any scalar function $v = xy^2 + x^2yz + xyz^2$ 6 M

3.

a) Derive the expression for Electric field intensity due to infinite line charge of density ρ_l C/m. 8 M

b) A line charge density of 24 nC/m is located in free space on the line y=1, z=2

(i) Find E at P(6,-1,3).

(ii) What point charge Q_A should be located at Q(-3,4,1) to cause E_y to be zero at P? 8 M

4.

a) Find the H at a point P(1.5,2,3) caused by a current of 24 A in $\hat{a}_z$ direction on Z – axis extending from

(i) Z = 0 to Z = 6

(ii) Z = 6 to Z = ∞

(iii) Z = - ∞ to Z = ∞ 8 M

b) In the Cylindrical region 0 <ρ<0.5m, the current density is J = 4.5 $e^{-2\rho}\hat{a}_z$ A/m^2 and 0 Elsewhere. Use amperes law to find H. 8 M

5.

a) What is inconsistency in Amperes law? How Maxwell modified it? 6 M

b) A circular loop of 10cm radius is located in the x-y plane in a field given by B = 0.5 (3 $\hat{a}_y$+ $\hat{a}_z$) cos(377t) tesla. Find the EMF induced in the loop. 4 M

c) The interface defined y = 0 separates two media with $\epsilon_1 = 2\ \epsilon_0$ and $\epsilon_2 = 3\epsilon_0$. Assume that interface is charge free, given that $E_1 = (4\hat{a}_x + 5\hat{a}_y + 6\ \hat{a}_z\ )$ V/m . Find D_1, E_2,D_2. 6 M

6.

a) Derive the Expression for Attenuation constant and phase constant from Propagation constant. 6 M

b) Describe the Wave propagation in perfect dielectric, good dielectric, good Conducting medium. 10 M