BE (Forth Semester)

Electronics and Telecommunication

Electromagnetic Fields and Transmission Lines - 328456(28)

2014 - Winter Session , New Scheme

Chapter 1

1 write physical interpretation of curl and divergence. **2**

2 A vector field is given by $\overrightarrow{A} = yz\ a_x + xz\ a_y + xz\ a_y$ show that it is both irrotional and solenoidal. **(4+3)** **7**

3 A sheet of charge $\rho_s = 2nC/m^2$ is present at the plance x =3 in free space, and a line charge ρ_L = 20 nC/m is located at x =1, z =4. Find the $\overrightarrow{E}$ at P (4,5,6) **7**

4 Derive the expression for $\overrightarrow{E}$ at z = h due to ring r = a having unform line charge density ρ C/m placed in z = 0 plane. **7**

Chapter 2

1 Derive the relation-ship between electric field intensity and electric potential for static case. **2**

2 Give the potential field V =50 x y z, Volt in free space, find the total energy stored within the cube 0 < x,y,z < 2m **7**

3 Let $\overrightarrow{D} = 4xy\ a_x + 2\ (\ x^2 + y^2)\ a_y + 4yz\ a_z$ C/m^2. Evaluate surface integrals to find the total charge enclosed in the rectangular parallelepiped (0 < x < 2, 0 < y < 3, 0< z < 5 m) . **7**

4 Given the potential field V =$\frac{50\sin\theta}{r^2}$ volt in sperical coordinates in free space **7**

(i) Determine whether V satisfies Laplace equation

(ii) Find the total charge stored inside the spherical shell 1 < r <2

(3+4)

Chapter 3

1 Derive relation $\overrightarrow{E} = - \nabla \phi - \frac{\partial \overrightarrow{A}}{\partial t}$ where ϕ is scalar electric potenital and $\overrightarrow{A}$ is vector magnetic potential. **7**

2 A coaxial cable whose inner conductor having radius 'a' caarries a total current of I ampere in a_z direction where outer conductor having inner radius 'b' and outer radius 'c' carries total current in $-a_z$ direction. Find $\overrightarrow{H}$ at **7**
(i) point $\rho < a$
(ii) point where $\rho > a$ but $\rho < b$
(iii) point $b < \rho$ **(3+1+3)**

3 A perfectly conducting filament containing a small 500 Ω resistor is formed into a square loop. as shown in fig. Find I(t) if $\overrightarrow{B} = 0.2 \cos 120 \pi t \, a_z$ tesla **7**

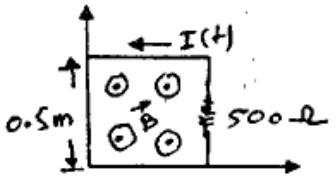

Fig. (1)

4 $\overrightarrow{H} = 6 r \sin \phi + 18 r \sin\theta \cos\phi \, a_\phi$, evaluate both sides of Stoke's theorem for the portion of the cone $\theta = 0.1 \pi$ bounded by $r = 2$, $r = 4$; $\phi = 0$ and $\phi = 0.3 \pi$ Let the direction at dS be $+ a_\theta$ **7**

Chapter 4

1 The wavelength of wave with a propagation constant = ($0.1\pi + j0.2\pi$) $meter^{-1}$ will be = ? **7**

2 A lossless dielectric medium has $\sigma = 0$, $\mu_r = 1$ and $\varepsilon_r = 4$. An EMW has magnetic field components expressed as : $\overrightarrow{H} = -01 \cos(\omega t - z) a_x + 0.5 \sin(\omega t - z) a_y$ $\frac{A}{m}$ Find phase constant β, angular velocity ω, the wave impedance η and the components of electric field intensity of the wave. **(1+1+1+4)** **7**

3 A plane EMW is given by $\overrightarrow{E} = Re [E_0 e^{j(\omega t - j\beta)} a_x]$ and $\overrightarrow{H} = Re [H_0 e^{j(\omega t - \beta z)} a_y]$ where E_0 and H_0 are real. calculate the instantaneous and average poynthing vectors. **(3+4)** **7**

4 Explain clearly the meaning of the term polarization as applied to electromagnetic waves. what is the polarization of the electric field vector of a uniform plane wave travelling in the +ve Z direction, represented by : **7**
(i) $\overrightarrow{E} = E_0 (a_x + j a_y)$
(ii) $\overrightarrow{E} = E_0 (a_x + a_y)$

Chapter 5

1 Differentiate loss less and distortion less transmission lines ? **2**

2 A lossless transmission line having $Z_0 = 120\ \Omega$ is operating at = 5×10^8 rad/sec. if the velocity on the line is 2.4×10^8 m/sec. Find **7**

(i) L

(ii) C

(iii) Let Z_L be represented by an inductance 0.6 μH in series with a 100 Ω, then find reflection coefficient and standing wave ratio.

(2+2+2+1)

3 Define voltage reflection coefficient and voltage standing wave ratiio in incorrectly terminated two wire transmission line and derive the relationship between these two. ($1\frac{1}{2} + 1\frac{1}{2}$, 4) **7**

4 An open wire transmission line having characteristic impedance of 600 Ω is terminated by a resistive load of 900 Ω calculated the voltage standing wave ratio and design a single stub to match the load **(3+4)** **7**