

Total No. of Questions : 8]

SEAT No. :

P2381**[4758] - 538**

[Total No. of Pages :3

T.E. (Electronics & Telecommunication)
ELECTROMAGNETICS AND TRANSMISSION LINES
(2012 Pattern) (304184) (Semester - I) (End Semester)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

Q1) a) Derive the expression for electric field intensity \bar{E} at a point 'P' due to infinite line charge with uniform line charge density ' ρ_L '. [6]

b) Derive Laplace and Poisson equations for electrostatics & hence state physical significance of Laplace & Poisson equations. [6]

c) A current sheet $\bar{k} = 9\bar{a}_y$ A/m is located at $z = 0$. The region 1 which is at $z < 0$ has $\mu_{r1} = 4$ and region 2 which is at $z > 0$ has $\mu_{r2} = 3$.

Given : $\bar{H}_2 = 14.5\bar{a}_x + 8\bar{a}_z$ A / m Find \bar{H}_1 [8]

OR

Q2) a) Derive the expression for the capacitance of spherical plate capacitor. [6]

b) Derive expression for Biot & Savart law using magnetic vector potential. [6]

c) $\bar{D} = \frac{5x^3}{2} \hat{a}_x$ c/m². Prove divergence theorem for a volume of cube of side 1m. Centered at origin & edges parallel to the axis. [8]

P.T.O.

- Q3) a)** Define displacement current and displacement current density & hence show that [8]

$$\nabla \times \mathbf{H} = \mathbf{J}_c + \mathbf{J}_d$$

Where $\mathbf{J}_c \rightarrow$ conduction current density

$\mathbf{J}_d \rightarrow$ Displacement current density

- b) Select values of K such that each of the following pairs of fields satisfies Maxwell's equation. [8]

i) $\bar{\mathbf{E}} = (Kx - 100t)\bar{a}_y \text{ V / m}$

$$\bar{\mathbf{H}} = (x + 20t)\bar{a}_z \text{ A / m}$$

$$\mu = 0.25 \text{ H / m} \quad \epsilon = 0.01 \text{ F / m}$$

ii) $\bar{\mathbf{D}} = 5x \hat{a}_x - 2y \hat{a}_y + Kz \hat{a}_z \text{ } \mu\text{C / m}^2$

$$\bar{\mathbf{B}} = 2\bar{a}_y \text{ mT}$$

$$\mu = \mu_0 \quad \epsilon = \epsilon_0$$

OR

- Q4) a)** What is mean by uniform plane wave, obtain the wave equation travelling in free space in terms of E. [8]

- b) Derive Maxwell's equations in differential and integral form for time varying and free space. [8]

- Q5) a)** Derive the expression for characteristic impedance (Z_0) and propagation constant (γ) in terms of primary constants of transmission line. [8]

- b) A cable has an attenuation of 3.5dB/Km and a phase constant of 0.28 rad/km. If 3V is applied to the sending end then what will be the voltage at point 10 km down the line when line is terminated with Z_0 . [8]

OR

- Q6) a)** Explain the phenomenon of reflection of transmission line and hence define reflection coefficient. [6]

- b) A transmission line cable has following primary constants. [10]

$$R = 11 \Omega/\text{km}, G = 0.8 \mu\text{mho} / \text{km}$$

$$L = 0.00367 \text{ H/Km} \quad C = 8.35 \text{ nF/km}$$

At a signal of 1 kHz calculate

- i) Characteristic impedance Z_0
- ii) Attenuation constant (α) in Np/Km
- iii) Phase constant (β) in radians / Km
- iv) Wavelength (λ) in Km
- v) Velocity of signal in Km/sec.

- Q7)** a) What is the impedance matching? Explain necessity of it, what is stub matching? Explain the single stub matching with its merits and demerits. [9]

- b) Explain standing wave and why they generate? Derive the relation between the SWR and magnitude of reflection coefficient? [9]

OR

- Q8)** a) What do you mean by distortionless line. Derive expression for characteristic impedance and propagation constant for distortionless line. [8]

- b) The VSWR on a lossless line is found to be '5' and successive voltage minima are 40 cm apart. The first voltage minima is observed to be 15cm from load. The length of a line is 160cm and characteristic impedance is 300Ω . Using Smith chart find load impedance, sending end impedance. [10]

