Total No. of Questions : 8]

SEAT No. :

P2431

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[5253]-154

T.E. (E & TC)

ELECTROMAGNETICS AND TRANSMISSION LINE

(2012 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*

Q1) a) Using Gauss's law, derive an expression for electric field intensity $(\bar{E})$, due to infinite line charge with uniform line charge density ρ_L, placed along entire z-axis. **[7]**

b) Two homogeneous isotropic dielectrics meet on plane z = 0 for z > 0, $E_{r_1} = 4$ and for z < 0, $E_{r_2} = 3$. A uniform electric field $\bar{E}_1 = 5\bar{a}x - 2\bar{a}y + 3\bar{a}z$ kv/m exists for $z \geq 0$, find : **[6]**

i) $\bar{E}_2$ for ≤ 0

ii) The angle between $\bar{E}_2$ and interface

iii) The energy density in $z \geq 0$

c) Using Biot-Savart Law, find magnetic field intensity $(\bar{H})$, due to infinitely long straight filament carrying current 'I' amperes. **[7]**

OR

Q2) a) A point charge of 16nc is located at Q(2, 3, 5) in free space and a uniform line charge of 5nc/m is at the intersection of the planes x = 2 and y = 4. If the potential at the origin is 100v, find potential (v) at point p(4, 1, 3). **[7]**

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b) Derive an expression for capacitance of a parallel plate capacitor. **[5]**

c) Derive point form of Amperis Circuital Law. $(\nabla \times \overline{H} = \overline{J})$ **[8]**

Q3) a) State and prove Poynting theorem and explain the significance of each term. **[8]**

b) State the Maxwell's equation in point form for static electric and steady magnetic fields. Explain how these are modified for time varying fields. **[10]**

OR

Q4) a) What are uniform plane waves? Derive an expression for Helmholtz wave equation. **[10]**

b) In a medium characterized by

$\sigma = 0,\ \mu = \mu_0\ \in = \in_0$ and $\overline{E} = 20\ \sin(10^8\, t - \beta z)\bar{a}y$ v/m. **[8]**

Calculate β and $\overline{H}$.

Q5) a) What do you mean by distortion less line? Derive the expression for characteristic impedance and propagation constant for distortion less line. **[8]**

b) State primary and secondary constants of a transmission line and hence derive relationship between primary and secondary constants of transmission line. **[8]**

OR

Q6) a) A transmission line has the following primary constants. **[10]**

R = 11 Ω/km

L = 0.00367 H/km

G = 0.8 μ℧/km

C = 8.35 nF/km

At a signal of 1 KHz calculate :

i) Zo

ii) Attenuation constant in Np/km

iii) Phase constant in rad/km

iv) Wavelength

v) Velocity

b) Explain the concept of reflection on transmission line and hence define reflection coefficient. **[6]**

Q7) a) What are standing waves? Derive the relation between the SWR and magnitude of reflection coefficient. **[8]**

b) A Lossless transmission line with characteristic impedance of 50Ω is 30m long and operates at 2 MHz frequency. The line is terminated with a load of (60 + j 40). If phase velocity is 0.6c, where 'c' is speed of light, then find using SMITH CHART : **[8]**

i) Reflection coefficient (Γ)

ii) VSWR

iii) Input Impedance (Zin)

OR

Q8) a) Derive an expression for voltage and current on dissipation less line. **[8]**

b) What is impedance matching? Explain necessity of it. What is stub matching? Explain stub matching with its merits and demerits. **[8]**

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