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T.E. (Electronics & Telecommunication) (End Semester)

ELECTROMAGNETICS AND TRANSMISSION LINES (Semester - I)

(2012 Pattern)

Time :3 Hours] *[Max. Marks : 70*

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

b) Derive the expression for the capacitance of spherical plate capacitor. **[6]**

c) A current sheet $\bar{K} = 9\hat{a}y \text{ A/M}$ is located at Z = 0. The region 1 which is at Z < 0 has $\mu r_1 = 4$ and region 2 which is at Z > 0 has $\mu r_2 = 3$ **[8]**

Given : $\bar{H}_2 = 14 \cdot 5\bar{a}_x + 8\hat{a}z \text{ A/M}$

Find $\bar{H}_1$

OR

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

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

c) $\bar{D} = \frac{5x^3}{2} \hat{a}x \ {}^{c}\!/\!_{m^2} \cdot$ prove divergence theorem for a valume of cube of side 1m. Centened at origin & edges parallel to the axis. **[8]**

Q3) a) Select values of K such that each of the following pairs of fields satisfies maxwells's equation

i) $\bar{E} = (K_x - 100t)\ \bar{a}b_y \ \ v/m$

$\bar{H} = (x + 20t)\ \bar{a}_z \ A/m$ **[8]**

$\mu = 0.25\ H/m \quad \in = 0.01\ F/m$

ii) $\bar{D} = 5x\bar{a}x - 2y\,\bar{a}\,y + kz\,\bar{a}\,z\ \mu c / m^2$

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

$\mu = \mu_0 \quad \in = \in_0$

b) Define displacement current and displacement current density & hence show that **[8]**

$$\nabla \times H = Jc + Jd$$

Where JC $\rightarrow$ conduction current density

Jd $\rightarrow$ displacement current density

OR

Q4) a) Derive maxwell's equations in differential and integral form for time varying and free space. **[8]**

b) What is mean by uniform plane wave? obtain the wave equation travelling in free space in terms of E **[8]**

Q5) a) Explain the phenomenon of reflection of transmission line and hence define reflection coefficient. **[6]**

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

$R = 11\Omega$/ km $\qquad G = 0.8\ \mu mho / km$

$L = 0.00367\,H / km \quad C = 8.35\ nF / km$

At a signal of 1 KHz calculate

i) Characteristic impedance Zo

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

OR

Q6) a) A cable has an attenuation of 3.5 dB/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 10km down the line when line is terminated with Zo **[8]**

b) Derive the expression for characteristic impedance (Zo) and propagation constant (r) in terms of primary constants of transmission line. **[8]**

Q7) a) Derive the expression for input impedance of a transmission line. Hence state the effect of open circuit & short circuit of line or input impedance. **[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 is impedance matching? Explain necessity of it, What is stub matching? Explain the single stub matching with its merits & demerits. **[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 160 cm and characteristic impedance is 300 Ω. Using smith chart find load impedance sending end impedance. **[10]**

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