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[This question paper contains 3 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1269

A

Unique Paper Code : 32517919

Name of the Paper : Transmission Lines, Wave Propagation and Antenna

Name of the Course : B.Sc. (H) Electronics (under CBCS) (DSE)

Semester : VI

Duration : 3½ Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **seven** questions in all, out of which you have to attempt any **five** questions.
3. **All** questions carry equal marks.

1. (a) What do you understand by reflection of plane wave at oblique incidence? Derive Fresnel's equations for perpendicular polarization.

(b) A uniform plane wave in air with

$$\mathbf{E} = 8 \cos (\omega t - 4x - 3z) \mathbf{a}_y \text{ V/m}$$

is incident on a dielectric slab ( $z \geq 0$ ) with  $\mu_r = 1.0$ ,  $\epsilon_r = 2.5$ ,  $\sigma = 0$ . Find the polarization of the wave, the angle of incidence, the reflected  $\mathbf{E}$  field and the transmitted  $\mathbf{H}$  field.

P.T.O.

2. (a) Find the expression for input impedance of a lossless transmission line of characteristic impedance  $Z_0$  and load impedance of  $Z_L$ .

(b) A distortionless transmission line has  $Z_0 = 80 \Omega$ ,  $\alpha = 40 \text{ mNp/m}$ ,  $\beta = 1.5 \text{ rad/m}$ . Find the line parameters  $R$ ,  $L$ ,  $G$ ,  $C$  and  $\lambda$  at 500 MHz.

3. (a) Obtain the field expressions for TM modes supported by a parallel conducting plate waveguide using appropriate boundary conditions.

(b) Calculate the cutoff wavelength and wave impedance in the case of rectangular waveguide with dimensions of  $5 \times 2 \text{ cm}$  propagating  $\text{TM}_{11}$  modes at 9GHz frequency.

4. (a) Obtain the expressions for electric field and magnetic field of a Hertzian Dipole Antenna at far zone.

(b) An electric field strength of  $20 \mu\text{V/m}$  is to be measured at an observation point  $\theta = \pi/2$ , 600 km from a half-wave (resonant) dipole antenna operating in air at 60MHz. What is the length of the dipole? Calculate the current that must be fed to the antenna. Find the average power radiated by the antenna and if a transmission line with  $Z_0 = 75 \Omega$  is connected to the antenna, determine the standing wave ratio.

5. (a) What do you mean by Transmission Lines? What are their applications? Discuss Shorted line, Open Circuited line and Matched line.

(b) A telephone line has  $R = 10 \Omega/\text{Km}$ ,  $L = 3.7 \text{ mH/km}$ ,  $C = 8.3 \text{ nF/km}$  and  $G = 0.4 \mu\text{mho/km}$ . Determine  $Z_0$ ,  $\alpha$  and  $\beta$  at 1 KHz.

6. (a) What are waveguide resonators? Derive the field expressions for TM mode for rectangular cavity resonator.

(b) A rectangular waveguide has  $a = 2 \text{ cm}$  and  $b = 1.145 \text{ cm}$ ,  $\mu_r = 1$  and  $\epsilon_r = 2.5$ . Find the cutoff wavelength and cutoff frequency for  $\text{TE}_{10}$  and  $\text{TM}_{11}$  modes.

7. (a) What are antenna characteristics? Explain Directive Gain and Power Gain.

(b) Determine the electric field intensity at a distance of 10 km from an antenna having a directive gain of 5dB and radiating a total power of 20 kW.

#### Physical Constants

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$$

$$c = 3 \times 10^8 \text{ m/s}$$