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Question Paper Code : 21182

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Electronics and Communication Engineering

EC 1303 — TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

Time : Three hours Maximum : 100 marks

(Smith Chart to be provided)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the condition to construct a distortionless transmission line.

2. What are the advantages and disadvantages of continuous loading of transmission line?

3. Define Standing Wave Ratio.

4 Calculate the characteristic impedance of a quarter wave transformer to match a load of 100Ω to a source of 250Ω.

5. List the characteristics of TEM wave.

6. A pair of perfectly conducting planes, separated by 8cm in air. For TM_{10} mode excitation, find the Cut-off frequency?

7. What do you meant by Dominant Mode?

8. Define wave impedance of a wave guide.

9. What are the various types of resonators?

10. Define Q factor of a cavity resonator.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Obtain the general solution for voltage and current along the transmission line. Also give the two forms of voltage and current along the transmission line terminated by an impedance. (12)

(ii) The secondary constants of a line at a frequency of 1 *KHz* are $z_0 = 710\angle -16°\Omega$, $\alpha = 0.01$ nepers/Km and $\beta = 0.035\ rad/Km$. Determine the primary constants of the line. (4)

Or

(b) (i) Explain the two types of distortions along the transmission line and deduce the condition for distortionless line. (10)

(ii) A telephone cable 64 Km long has a resistance of 13 ohms/Km and a capacitance of $0.08\mu f/Km$. Calculate the attenuation, velocity and wavelength of the signal at a frequency of 1000 Hz. (6)

12. (a) (i) Explain single stub matching on a line. Deduce the expression for the length and location of single stub tuner for impedance matching. (10)

(ii) A loss less line 0.4375λ long has an input impedance $Z_s / R_o 1.2 + j\ 0.95$. Using Smith Chart, find the load impedance and standing wave ratio. (6)

Or

(b) (i) Explain the application of Quarter wave line. (8)

(ii) Explain the construction of Circle Diagram. Deduce the expression for constant-S and constant βs circle. (8)

13. (a) (i) Explain the attenuation of TE waves guided between parallel conducting planes. (10)

(ii) A pair of perfectly conducting planes is separated by 8cm in air. For a frequency of 5 *GHz* with TE_{10} mode excited, find the cut-off frequency, characteristic impedance, phase and group velocities. (6)

Or

(b) Deduce the expressions of electric and magnetic fields of TM waves guided between parallel planes.

14. (a) Deduce the expressions of electric and magnetic fields of TE waves guided along a rectangular Waveguide.

Or

(b) (i) Write short notes on Wave impedance of TE and TM waves in rectangular wave guides. (10)

(ii) Calculate the cut-off frequency for a $TE_{1,0}$ wave in air in a rectangular waveguide measuring 5 cm by 2.5 cm. Also calculate the phase and group velocities at a frequency of 6 GHz. (6)

15. (a) (i) Obtain the solution of field equations in cylindrical co-ordinates. (8)

(ii) A circular waveguide has an internal diameter of 5 cm. Calculate the cutoff frequencies for the following modes TM_{11} and $TM_{12}((ha)_{11} = 3.832$ and $(ha)_{12} = 7.106)$. (8)

Or

(b) (i) What is a cavity resonator? Derive an expression for the frequency of oscillation of rectangular cavity resonator. (10)

(ii) A metal box is of $3cm \times 4\ cm \times 5cm$ size. If it is filled with air, find the resonant frequency for TE_{102}. (6)