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Question Paper Code : 63175

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016

Fifth Semester

Electronics and Communication Engineering

EC 1303 — TRANSMISSION LINES AND WAVEGUIDES

(Regulations 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. A transmission line with an incident voltage of 5V produces a reflected voltage of 3V. Determine the SWR.

4. Determine the characteristic impedance for a quarter wave transformer that is used to match a 50 Ω line to a 60 Ω resistive load.

5. Assume a wave is propagates in a parallel plane waveguide. The frequency of the wave is 6000 MHz and the plane separation is 7cm. Calculate the cutoff wavelength of the dominant mode.

6. Define TEM waves.

7. For an air filled copper X-band waveguide with dimension a = 2.286 cms and b = 1.016 cms, determine the cut-off frequencies for TE_{11} and TM_{11} modes.

8. Which are the non-zero field components for the TE_{10} and TM_{11} mode in a rectangular waveguide?

9. What are the applications and disadvantages of circular waveguides?

10. Bring out the relationship between quality factor and Bandwidth of a resonator.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the transmission line equations and obtain solutions for the voltage and current on a transmission line. (12)

(ii) A transmission line has $R = 2\Omega/m$, $L = 8nH/m$, $G = 0.5 \times 10^{-3}$ mhos/m and C = 0.23 pF/m. Determine the phase constant at 1 GHz (4)

Or

(b) (i) Derive the condition for the distortionless operation of a transmission line. (10)

(ii) Discuss the inductance loading of telephone cables. (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 $Z_s/R_o 1.2 + j0.95$. 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) When a wave 6 GHz is to be propagated between two parallel conducting plates separated by 60 mm, find the modes that will propagate through the guide. (8)

(ii) Derive the field expressions for TEM waves guide by a parallel conducting plane. (8)

Or

(b) (i) Define wave impedance. Obtain the expressions for wave impedance of TE, TM and TEM waves in two conducting planes. (10)

(ii) The parallel plate waveguide has plate separation 1 cm and filled with a perfect dielectric of dielectric constant 9. Find the cutoff frequencies and next higher TM modes.

14. (a) Describe the propagation of TE waves in a rectangular waveguide with necessary expressions for the field components and also plot the field configurations for the dominant and TE_{11} modes. (16)

Or

(b) (i) Derive the field components expression for TE mode in Rectangular waveguide stating the necessary assumptions. (10)

(ii) An air filled rectangular waveguide of dimensions a = 6 cm and b = 4 cm operates in the TM_{11} mode. Find the cutoff frequency, guide wavetength and phase velocity at a frequency of 3 GHz. (6)

15. (a) Discuss the propagation of TE waves in a circular waveguide with relevant expressions and also discuss the dominant mode. (16)

Or

(b) (i) Explain the principle, operation and applications of rectangular cavity resonators. (10)

(ii) Give a brief note on the excitation of different modes in a circular waveguide. (6)
