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Question Paper Code : 11371

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Fifth Semester

Electronics and Communication Engineering

EC 1303 — TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

Time : Three hours   Maximum : 100 marks

(Smith Chart is to be provided)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Determine the characteristics impedance of a coaxial cable operating at extremely high frequencies with L = 483.12 nH/m and C = 24.15 pF/m.

2. Write the equations for the characteristics impedance and propagation constant of a telephone cable.

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 $50\,\Omega$ line to a $60\,\Omega$ resistive load.

5. Write the expression for the characteristic wave impedance for the TE and TM waves between parallel planes.

6. A 6 GHZ signal propagates between parallel planes with separation of 3 cm. Find the group velocity for the dominant mode.

7. A rectangular waveguide has a = 90 mm and b = 45 mm. Find the characteristic impedance of TE_{10} mode at 4 GHz.

8. What is meant by TEM mode?

9. What are the advantages and disadvantages of circular waveguide over rectangular waveguides?

10. What are the applications of cavity resonators?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the transmission line differential equations and obtain the general solutions for the voltage and current on the transmission line. (10)

(ii) The attenuation on a 50 Ω distortionless line is 0.01 dB/m. The line has a capacitance of 0.1 nF/m. Determine the resistance, inductance and conductance of the line. (6)

Or

(b) (i) Derive expression for the attenuation constant (α) and phase constant (β) of a transmission line in terms of R, L, G and C. (8)

(ii) A transmission line has R = 6 Ω/km, L= 2.2 mH/km, C = 0.005 μF/km and G = 0.05 micromho/km. Determine the characteristic impedance, attenuation and phase constants at KHz. (8)

12. (a) (i) Derive an expression for the input impedance of a lossless line. (8)

(ii) The SWR of a 50 Ω lossless line terminated in an unknown impedance is found to be 3.0. The distance between two successive voltage minima is 20 cm and the first minimum is located at 5 cm from the load. Determine the reflection coefficient and load impedance. (8)

Or

(b) (i) Explain the principle of single stub matching and also write the advantages of double stub matching. (8)

(ii) A 50 Ω transmission line is connected to a load impedance of (35-j47.5) Ω. Find the position and length of a short circuited stub required to match the line using Smith chart. (8)

13. (a) (i) Discuss the transmission of TM waves between parallel perfectly conducting planes with necessary expressions for the field components. (12)

(ii) Discuss the characteristics of TE and TM waves between parallel planes. (4)

Or

(b) (i) Explain the attenuation of TE and TM waves between parallel planes with necessary expressions and diagrams. (12)

(ii) Write a brief note on wave impedances. (4)

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 wavelength and phase velocity at a frequency of 3 GHz. (6)

15. (a) Discuss the propagation of TE and TM waves in a circular waveguide with relevant expressions and diagrams for the field components. (16)

Or

(b) Explain the principle and operation of circular and semicircular cavity resonators and also discuss the Q factor of cavity resonators. (16)
