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Question Paper Code : 27201

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Electronics and Communication Engineering

EC 6503 — TRANSMISSION LINES AND WAVE GUIDES

(Regulations 2013)

Time : Three hours Maximum : 100 marks

(Normalised Smith chart is to be provided)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Find the reflection coefficient of a 50 Ω transmission line when it is terminated by a load impedance of 60+j40 Ω.

2. What is meant by distortion less line?

3. A lossless transmission line has a shunt capacitance of 100 pF/m and a series inductance of 4 μH/m. Determine the characteristic impedance.

4. For the line of zero dissipation, what will be the values of attenuation constant and characteristic impedance?

5. List the applications of a Quarter-wave line.

6. Distinguish between single stub and double stub matching.

7. Determine the value of L required by a constant-K T-section high pass filter with a cut off frequency of 1 KHz and design impedance of 600 Ω.

8. What are the advantages of m-derived filters?

9. A rectangular waveguide of cross section 5 cm × 2 cm is used to propagate TM_{11} mode at 10 GHz. Determine the cut-off wave length.

10. Write the applications of cavity resonators.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in detail about the wave-form distortion and also derive the condition for distortion less line. (10)

(ii) Derive the expressions for input impedance of open and short circuited lines. (6)

Or

(b) (i) A parallel-wire transmission line is having the following line parameters at 5 KHz. Series resistance ($R = 2.59 \times 10^{-3}\ \Omega/m$), Series inductance ($L = 2\,\mu H/m$), Shunt conductance ($G = 0$ ℧/m) and capacitance between conductors ($C = 5.56$ nF/m). Find the characteristic impedance, attenuation constant, phase shift constant, velocity of propagation and wavelength. (10)

(ii) A 2 meter long transmission line with characteristic impedance of 60+j40 Ω is operating at $\omega = 10^6$ rad/sec has attenuation constant of 0 rad/m. If the line is terminated by a load of 20+j50 Ω, determine the input impedance of this line. (6)

12. (a) Discuss the various parameters of open-wire and co-axial lines at radio frequency. (16)

Or

(b) (i) A lossless line in air having a characteristic impedance of 300 Ω is terminated in unknown impedance. The first voltage minimum is located at 15 cm from the load. The standing wave ratio is 3.3. Calculate the wavelength and terminated impedance. (6)

(ii) Derive the expression that permit easy measurements of power flow on a line of negligible losses. (10)

13. (a) (i) What is Quarter-wave line? (4)

(ii) A 75 Ω lossless transmission line is to be matched with a 100-j80 Ω load using single stub. Calculate the stub length and its distance from the load corresponding to the frequency of 30 MHz using Smith chart. (12)

Or

(b) (i) Discuss the principle of double stub matching with neat diagram. (8)

(ii) A 300 Ω transmission line is connected to a load impedance of (450-j600) Ω at 10 MHz. Find the position and length of a short circuited stub required to match the line using Smith chart. (8)

14. (a) (i) Explain the operation and design of constant-K T section band elimination filter with necessary equations and diagrams. (8)

(ii) Design a constant K band pass filter (both T and π sections) having a design impedance of $600\,\Omega$ and cut-off frequencies of 1 KHz and 4 KHz. (8)

Or

(b) (i) Design an m-derived T section low pass filter having cut off frequency of 1 KHz. Design impedance is 400 Ω and the resonant frequency is 1100 Hz. (4)

(ii) Derive the equations for the characteristic impedance of symmetrical T and π networks. (6)

(iii) Discuss the properties of symmetrical network in terms of characteristic impedance and propagation constant. (6)

15. (a) A rectangular air-filled copper waveguide with dimension 0.9 inch × 0.4 inch cross section and 12 inch length is operated at 9.2 GHz with a dominant mode. Find cut-off frequency, guide wave-length, phase velocity, characteristics impedance and the loss. (16)

Or

(b) (i) Using Bessel function derive the TE wave components in circular wave guides. (10)

(ii) Calculate the resonant frequency of an air filled rectangular resonator of dimensions a = 2 cm, b = 4 cm and d = 6 cm operating in TE_{101} mode. (6)