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Question Paper Code : 31365

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Electronics and Communication Engineering

EC 2305/EC 55 — TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

(Common to PTEC 2305 – Transmission Lines and Waveguides for B.E. (Part-Time) Fourth Semester Electronics and Communication Engineering – Regulation 2009)

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

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

3. Write the need for inductance loading of telephone cables.

4. A transmission line has a characteristic impedance of 400 Ω and is terminated by a load impedance of $(650 - j475)\,\Omega$. Determine the reflection coefficient.

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

6. Write the conditions to be satisfied by a dissipationless line.

7. A wave is propagated in a parallel plane waveguide. The frequency is 6 GHz and the plane separation is 3 cm. Determine the group and phase velocities for the dominant mode.

8. Define TEM waves.

9. A rectangular waveguide with a = 7 cm and b = 3.5 cm is used to propagate TM_{10} at 3.5 GHz. Determine the guided wavelength.

10. Write the applications of cavity resonators.

PART B — (5 × 16 = 80 marks)

11. (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 Ω and cut off frequencies of 1 KHz and 4 KHz. (8)

Or

(b) (i) Explain the principle and operation of crystal filters with neat diagrams. Write its applications. (10)

(ii) Design an m-derived T section low pass filter having cutoff frequency of 1 KHz. Design impedance is 400 Ω and the resonant frequency is 1100 Hz. (6)

12. (a) (i) Derive the transmission line equations and hence obtain expressions for the voltage and current on a transmission line. (10)

(ii) A transmission line has L = 10 mH/m, C = 10^{-7} F/m, R= 20 Ω/m and G = 10^{-5} mhos/m. Find the input impedance at a frequency of $\left(\frac{5000}{2\pi}\right)$ Hz, if the line is very long. (6)

Or

(b) (i) Discuss the types of waveform distortion introduced by a transmission line. Derive the conditions for the distortionless operation of a transmission line. (10)

(ii) The characteristic impedance of a Uniform transmission line is 2309.6 Ω at 800 Hz. At this frequency, the propagation constant is $0.054(0.0366 + j0.999)$ per km. Determine R and L. (6)

13. (a) (i) Derive an expression for the input impedance of dissipationless lines. Deduce the input impedance of open and short circuited dissipationless lines. (10)

(ii) 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)

Or

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

(ii) A 300 ohm transmission line is connected to a load impedance of (450– j 600) 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) Discuss the transmission of TM waves between parallel perfectly conducting planes with necessary expressions for the field components. Discuss briefly the manner how the wave travels and phase and group velocities between the two parallel planes. (16)

Or

(b) (i) Discuss briefly the attenuation of TE and TM waves between parallel planes. (10)

(ii) Give a brief note on the transmission of TEM waves between parallel planes. (6)

15. (a) (i) Describe the propagation of TE waves in a rectangular waveguide with necessary expressions for the field components. (12)

(ii) An air filled rectangular waveguide of dimensions a = 4.5 cm and b = 3 cm operates in the TM_{11} mode. Find the cut off wavelength and characteristic wave impedance at a frequency of 9 GHz. (4)

Or

(b) (i) Explain briefly the propagation of TM waves in a circular waveguide with necessary expressions for the field components. (10)

(ii) Give a brief note on excitation of modes in rectangular waveguides. (6)
