Reg. No. : [| | | | | | | | | | |]

Question Paper Code : 80451

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth Semester

Electronics and Communication Engineering

EC 2305/EC 55/10144 EC 504 — TRANSMISSION LINES AND WAVEGUIDES

(Regulations 2008/2010)

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define propagation constant.

2. State the significance of crystal filters in communication system.

3. What is characteristic impedance?

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

5. How will you make standing wave measurements on coaxial line?

6. List the applications of the smith chart.

7. Why is TEM mode not supported by waveguide?

8. State the significance of dominant mode of propagation.

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) Design a constant K band pass filter derving expressions for the circuit components. A constant K highpass filter cuts off at a frequency of 2300 Hz. The load resistance is 500 Ω. Calculate the values of components used in the filter.

Or

(b) Design a composite high pass filter to operate into a load of 600 Ω and have a cut off frequency of 1.2 KHz. The filter is to have one constant k section, one m-derived section with f_∞ = 1.1 KHz and suitably terminationed half section. Discuss the merits and demerits of m-derived filter and crystal filter.

12. (a) Explain the condition for distortionless line. Characteristic impedance of a transmission line at 8 MHz is (40-2j) ohm and the propagation constant is (0.01 + j 0.18) per meter. Find the primary constants. (16)

Or

(b) Discuss following:

(i) Reflection on a line not terminated in Z0. (8)

(ii) Open and short circuited lines. (8)

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) Derive the expression for the field strengths for TE wave between a pair of parallel perfectly conducting planes of infinite extent in the Y and Z directions. The plates are separated in X direction by 'a' meter. (16)

Or

(b) (i) Discuss the characteristics of TE and TM waves and also derive cut-off frequency and phase velocity from the propagation constant. (8)

(ii) A pair of parallel perfectly conducting plates is separated by 7 cm in air and carries a signal with frequency of 6GHz in TE1 mode. Find:

(1) cut-off frequency

(2) Phase constant

(3) Attenuation constant and phase constant for $f = 0.8\ f_c$

(4) Cut-off wavelength. (8)

15. (a) (i) Explain about excitation modes in rectangular wave-guide. (10)

(ii) Calculate resonant frequency of an air filled rectangular resonator of dimensions a = 3 cm, b = 2 cm and d = 4 cm operating in TE_{101} mode. (6)

Or

(b) Explain the propagation of electromagnetic waves in a cylindrical waveguide with suitable expressions. (16)