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Question Paper Code : 21365

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 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 × 2 = 20 marks)

1. A constant-k T section high pass filter has a cutoff frequency of 10 kHz. The design impedance is 600 ohms. Determine the value of L.

2. Define propagation constant of a Transmission Line.

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. Define SWR.

6. Design a quarter wave transformer to match a load of 200ohm to a source resistance 500 ohm. The operating frequency is 200 MHz.

7. What is degenerate mode in rectangular waveguide?

8. State the characteristics of TEM waves.

9. Write Bessel's function of first kind of order zero.

10. Mention the applications of cavity resonators.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the expression for characteristic impedance of symmetrical T and $\prod$ section networks. (12)

(ii) Bring out the relation between Decibel and Neper. (4)

Or

(b) Obtain the design equations for m-derived

(i) Bandpass (ii) Band elimination filters.

12. (a) (i) Derive the expressions for voltage and current along a parallel wire transmission line and obtain its solution. (8)

(ii) A cable has the following parameters:

R = 48.75ohm/km, L = 1.09mH/km, G = 38.75 μ mho/km, C = 0.059 μ F/km. Determine the characteristic impedance, propagation constant and wavelength for a source of f = 1600Hz and E_s = 1V. (8)

Or

(b) (i) Explain in detail the waveform distortion and also derive the condition for distortionless line. (8)

(ii) Explain the concept of reflection on a line not terminated in its characteristic impedance (Z_0). (8)

13. (a) Design a single stub matching Network (use Smith chart) for a transmission line functioning at 500 MHz terimated with a load impedance = Z_L = 300 +j250 Ω and with a characteristic impedance Z_o = 100 ohms. Use short circuited shunt stubs. Determine the VSWR before and after connecting the stub.

Or

(b) The input impedances of a $\lambda/8$ long, 50 Ω transmission line are Z_1 = 25 + j100 Ω Z_2 = 10-j50 Ω, Z_3 = 100 + j0 Ω and Z_4 = 0 + j50 Ω, when various load impedances are connected at the other end. In each case, determine the load impedance and the reflection coefficient at the input and load ends.

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 TE_1 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) Derive the expression for the field components of TE and TM waves in a circular waveguide. (16)

Or

(b) (i) A rectangular cavity resonator excited by TE_{101} mode at 20 GHz has the dimensions a = 2cm, b = 1cm. Calculate the length of the cavity. (8)

(ii) With neat diagrams, explain the concept of excitation of modes. (8)