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Question Paper Code : 20419

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018

Fifth/Fourth Semester

Electronics and Communication Engineering

EC 6503 — TRANSMISSION LINES AND WAVE GUIDES

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Smith chart to be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the line parameters of a transmission line.

2. What is a distortionless line? Give the condition for a distortionless line.

3. Define insertion loss.

4. Define propagation constant.

5. List the applications of smith chart.

6. What is the application of quarter wave line matching section?

7. What are called crystal filters?

8. Outline the disadvantages of constant–k filters.

9. What are cavity resonators?

10. Identify when an evanescent mode occurs?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the equation of attenuation constant and phase constant of transmission lines in terms of line constants R,L,C and G. (13)

Or

(b) Explain the theory of open and short circuited lines and also derive all expressions for input impedance. (13)

12. (a) Explain the parameters of open-wire and co-axial lines at radio frequency. (13)

Or

(b) A transmission line has $Z_0 = 1.0$, $Z_L = 0.2 - j0.2\Omega$ (i) What is z at $l = \lambda/4 = 0.25\lambda$? (ii) What is the VSWR on the line? (iii) How far from the load is at the first voltage minimum? Use smith chart. (5 + 4 + 4)

13. (a) Explain the technique of single stub matching and discuss operation of quarter wave transformer. (13)

Or

(b) Explain the procedure for obtaining the smith chart using R and X circles. (13)

14. (a) Derive the relevant equations of m derived low pass filter and design m derived T type low pass filter to work into the load of 600 Ω and cut off frequency a 5 KHZ and peak attenuation at $f_\infty = 1.25\ f_c$. (13)

Or

(b) Design a constant K. T section bandpass filter with cut off frequencies of 1KHZ and 4 KHZ. The design impedance is 600 ohms. (13)

15. (a) Write Bessel's differential equation and Bessel function and TM and TE waves in Circular wave guides. (13)

Or

(b) Derive the solution for TE and TM mode in rectangular wave guide. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A TE 10 wave at 10 GHz propagates in a brass $\sigma_c = 1.57 \times 10^7$ (S/m) rectangular wave guide with inner dimensions a = 1.5 cm and b = 0.6 cm, which is filled with $\varepsilon_r = 2.25$, $\mu r = 1$, loss tangent = 4×10^{-4}. Determine (i) the phase constant, (ii) the guide wavelength, (iii) the phase velocity, (iv) the wave impedance, (v) the attenuation constant due to loss in the dielectric, and (vi) the attenuation constant due to loss in the guide walls. (15)

Or

(b) A 50-Ω lossless transmission line is connected to a load composed of a 75-Ω resistor in series with a capacitor of unknown capacitance. If at 10 MHz the voltage standing wave ratio on the line was measured as 3, determine the capacitance C. (15)