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B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Electronics and Communication Engineering

EC 6503 — TRANSMISSION LINES AND WAVE GUIDES

(Regulation 2013)

Time : Three hours Maximum : 100 marks

(Use smith chart is to be provided)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the condition for a distortion less line.

2. Find the characteristic impedance of a line at 1600 Hz. if $Z_{OC} = 750\angle -30^\circ$ and $Z_{SC} = 600\angle -20^\circ\ \Omega$.

3. Write the expression for standing wave ratio interms of reflection co-efficient.

4. What do the nodes and anti-nodes on a standing wave represent?

5. Distinguish between single stub and double stub matching in a transmission line.

6. How is impedance matching achieved with stubs?

7. What are the major draw backs of a constant – k prototype filter?

8. A Constant T-Section high pass filter has a cut off frequency of 10 KHz and the design impedance is $600\,\Omega$. Determine the value of Shunt inductance L and Series Capacitance C.

9. Justify why TM_{01} and TM_{10} modes in a rectangular wave-guide do not exit.

10. How a cavity resonator is formed? What are its different types?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the general transmission line equations for voltage and current at any point on a Line. (13)

Or

(b) (i) Explain in detail about the reflection on a line not terminated by its characteristic impedance z_0. (7)

(ii) The Constant of a transmission line are R = 6 Ω/km, L = 2.2 mH/km, C = 0.005 μF/km and G = 0.25 × 10^{-3} mho/km, Calculate the characteristic impedance, attenuation constant and phase constant at 1000 Hz. (6)

12. (a) (i) Derive the line constants of a zero dissipation less line. (7)

(ii) Briefly explain on :

(1) Standing Wave (3)

(2) Reflection loss. (3)

Or

(b) Derive an expression for power and find the input impedance of dissipation less line. When the load is short circuited, open circuited and for a matched line. (13)

13. (a) (i) Explain the operation of quarter wave transformer and mention its important applications. (5)

(ii) A single stub is to match a load 400 Ω line to a load of 200-j 100 Ω. The Wave length is 3m. Determine the position and length of the short circuited stub. (8)

Or

(b) A 75 Ω lossless transmission line is to be matched with a(100–j80) Ω using single stub. Calculate the stub length and its distance from the load corresponding to the frequency of 30 MHz using Smith chart. (13)

14. (a) (i) Derive the equations for the characteristic impedance of symmetrical T and ∏ networks. (6)

(ii) Design T and ∏ section LPF which has series inductance 80 mH and shunt capacitance 0.022 μF. Find the f_c and design impedance. (7)

Or

(b) What is m derived filter? Draw a m-derived T section and π section low pass filter and explain the analysis of m derived low pass filter with respect to attenuation, phase shift and characteristic impedance with frequency profile respectively. (13)

15. (a) Derive an expression for the transmission of TE waves between parallel perfectly conducting planes for the field components. (13)

Or

(b) For a frequency of 10 GHz and planes separation of 5 cm in air, find the cut off frequency, cut off wavelength, phase velocity and group velocity of the wave. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A generator of 1 V, 1KHz supplies power to a 100 km open wire line terminated in Z_0 and having following the line parameter are $R = 10.4\,\Omega$/km, L = 3.8 mH/km, C = .0085 μF/km and G = 0.8×10^{-6} mho/km. Calculate Z_0, α, β, λ, v. Also find the received power. (15)

Or

(b) Design a low pass composite filter to meet the following specifications $f_c = 2000\,\text{Hz}$, $f_\infty = 2050\,\text{Hz}$, $R_k = 500\,\Omega$. (15)
