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Question Paper Code : 80344

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Electronics and Communication Engineering

EC 6503 — TRANSMISSION LINES AND WAVE GUIDES

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

(Normalized Smith chart is to be provided)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by distortionless line?
2. Find the Characteristic impedance of a line at 1600 HZ if $Z_{oc} = 750 \angle -30^\circ \Omega$ and $Z_{sc} = 600 \angle -20^\circ \Omega$.
3. Write the expression for the input impedance of open and short circuited dissipationless line.
4. Calculate Standing Wave Ratio and Reflection Coefficient on a line having the characteristic impedance $Z_0 = 300 \Omega$ and terminating impedance in $Z_R = 300 + j400 \Omega$.
5. Distinguish between Single Stub and Double Stub matching in a transmission line.
6. Give the application of eight wave line.
7. A constant-K, T-section high pass filter has a cut off frequency of 10 KH and the design impedance is 600Ω . Determine the value of shunt inductance L and series Capacitance C.
8. Define propagation constant in a symmetrical network.
9. Justify, why TM_{01} and TM_{10} modes in a rectangular waveguide do not exist.
10. An air-filled rectangular waveguide of inner dimensions 2.286×1.016 in centimeters operates in the dominant TE_{10} modes. Calculate the cut-off frequency and phase velocity of a wave in the guide at a frequency of 7 GHz.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in detail about the reflection on a line not terminated by its characteristic impedance Z_0 . (8)
- (ii) Derive the condition for minimum attenuation in a distortionless line. (8)

Or

- (b) A Communication line has $L = 3.67$ mH/km, $G = 0.08 \times 10^{-6}$ mhos/km, $C = 0.0083$ μ F/km and $R = 10.4$ ohms/km. Determine the characteristic impedance, propagation constant, phase constant, velocity of propagation, sending end current and receiving end current for given frequency $f = 1000$ HZ, Sending end voltage is 1 volt and transmission line length is 100 kilometers. (16)

12. (a) (i) Derive an expression for the input impedance of a dissipationless line and also find the input impedance is maximum and minimum at a distance 's'. (8)
- (ii) Find the sending end line impedance for a HF line having characteristic impedance of 50Ω . The line is of length (1.185λ) and is terminated in a load of $(110 + j80) \Omega$. (8)

Or

- (b) (i) Describe an experimental set up for the determination of VSWR of an RF transmission. (8)
- (ii) Briefly explain on :
- (1) Standing Waves
- (2) Reflection loss. (4 + 4)

13. (a) (i) Determine length and location of a single short circuited stub to produce an impedance match on a transmission line with characteristic impedance of 600Ω and terminated in 1800Ω . (8)
- (ii) Explain the operation of quarter wave transformer and mention its important applications. (8)

Or

- (b) (i) Find the sending end impedance of a line with negligible losses when characteristic impedance is 55Ω and the load impedance is $115 + j75 \Omega$ length of the line is 1.183 wave length by using smith chart. (10)
- (ii) Explain the significance of smith chart and its application in a transmission lines. (6)

14. (a) 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. (16)

Or

- (b) What is composite filter? Design a constant-K-low pass filter (T-section and π -section) and having cut-off at which 2.5 KHz and design resistance R_0 is 700Ω . Also find the frequency at which this filter produces attenuation of 19.1 dB. Find its characteristic impedances and phase constant at pass band and stop or attenuation band. (2 + 14)
15. (a) Derive an expression for the transmission of TE waves between parallel perfectly conducting planes for the field components. (16)

Or

- (b) (i) Write a brief note on circular cavity resonator and its application. (8)
- (ii) A TE_{11} wave is propagating through a circular waveguide. The diameter of the guide is 10 cm and the guide is air-filled. Given $X_{11} = 1.842$.
- (1) Find the cut-off frequency. (3)
- (2) Find the wavelength λ_g in the guide for a frequency of 3 GHz. (2)
- (3) Determine the wave impedance in the guide. (3)
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