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Question Paper Code : 70438

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

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 — ($10 \times 2 = 20$ 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. A lossless transmission line has a shunt capacitance of 100 pF/m and a series inductance of 4 μ H/m. Determine the characteristic impedance.

4. For the line of zero dissipation, what will be the values of attenuation constant and characteristic impedance?

5. List the applications of a Quarter-wave line.

6. Why a short-circuited stub is ordinarily preferred to an open-circuited stub?

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

8. Define propagation constant in a symmetrical network.

9. What are cavity resonators?

10. Identify when an evanescent mode occurs.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Explain in detail about the wave-form distortion and also derive the condition for distortion less line. (8)

(ii) Derive the expressions for input impedance of open and short circuited lines. (5)

Or

(b) (i) A parallel-wire transmission line is having the following line parameters at 5 KHz. Series resistance ($R=2.59\times10^{-3}\,\Omega/m$), Series inductance ($L=2\,\mu H/m$), Shunt conductance ($G=0$ Ʊ/m) and capacitance between conductors ($C=5.56\,nF/m$). Find the characteristic impedance, attenuation constant, phase shift constant, velocity of propagation and wavelength. (8)

(ii) A 2 meter long transmission line with characteristic impedance of 60+j 40 Ω is operating at $\omega=10^6$ rad/sec has attenuation constant of 0 rad/m. If the line is terminated by a load of $20 + j\,50\,\Omega$, determine the input impedance of this line. (5)

12. (a) Discuss in detail about the voltages and currents on the dissipation less line. (13)

Or

(b) (i) Derive the expression that permit easy measurements of Power flow on a line of negligible losses. (8)

(ii) A radio frequency line with $Z_0=70\,\Omega$ is terminated by $Z_L=115-j\,80\,\Omega$ at $\lambda = 2.5\,m$. Find the VSWR and the maximum and minimum line impedances. (5)

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 600 Ω and terminated in 1800 Ω. (7)

(ii) Explain the operation of quarter wave transformer and mention it's important applications. (6)

Or

(b) (i) Find the sending end impedance of a line with negligible losses when characteristic impedance is 55 Ω and the load impedance is 115 + j 75 Ω length of the line is 1.183 wave length by using smith chart. (8)

(ii) Explain the significance of smith chart and its application in a transmission lines. (5)

14. (a) (i) Derive the design equations of a constant K low pass filter. (7)

(ii) A π section filter network consists of a series arm inductance of 20 mH and two shunt capacitor of 0.16 μF each. Calculate the cut off frequency, attenuation and phase shift at 15 KHz. What is the value of nominal impedance in the pass band? (6)

Or

(b) Design m-derived T type lowpass filter connected to a load of 500 Ω with cut off frequency 4 KHz and peak attenuation at 4.15 KHz. (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 — ($1 \times 15 = 15$ 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- a 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)

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