Reg. No. | | | | | | | | | | | | |

Question Paper Code : 57294

27/7/16
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B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fifth Semester

Electronics and Communication Engineering

EC 6503 – TRANSMISSION LINES AND WAVE GUIDES

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

(Normalised Smith chart is to be provided)

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What is characteristics impedance ?
2. Define reflection loss.
3. What are the assumptions to simplify the analysis of line performance at high frequencies ?
4. Write the expression for standing wave ratio in terms of reflection co-efficient.
5. Why a quarter wave line is considered as a impedance inverter ? Justify.
6. What is a stub ? Why it is used in between transmission lines ?
7. What are the major draw backs of a constant – k prototype filter ?
8. Why a composite filter is designed and what are the various sections of the composite filter ?
9. Define dominant mode. What is the dominant mode of a rectangular wave guide ?
10. How a cavity resonator is formed ?

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Derive the transmission line equation and hence obtain expression for voltage and current on a transmission line. (10)

(ii) Prove that an infinite line equal to finite line terminated in its characteristic impedance. (6)

OR

(b) A generator of 1 V, 1000 Hz supplies power to a 100 km open wire line terminated in Z_0 and having following parameters

R = 10.4 ohm per km G = 0.8×10^{-6} mho per Km

L = 0.00367 Henry per Km C = 0.00835 μF per Km

Calculate Z_0, α, β, λ, v. Also find the received power. (16)

12. (a) (i) Derive the line constants of a zero dissipationless line. (8)

(ii) A line with zero dissipation has

R = 0.006 ohm per m C = 4.45 pF per m

L = 2.5 μH per m

If the line is operated at 10 MHz find Ro α, β, λ, v. (8)

OR

(b) (i) Discuss in detail about the variation of Input Impedance along open and short circuit lines with relevant graphs. (10)

(ii) A loss less line has a Standing Wave ratio of 4. The R_0 is 150 ohms and the maximum voltage measured in the line is 135 V. Find the power delivered to the load. (6)

13. (a) (i) Prove that the input impedance of a quarter wave line is Zin $=R_0^2/ZR$. (6)

(ii) Design a quarter wave transformer to match a load of 200 ohms to a source resistance of 500 ohms. Operating frequency is 200 MHz. (10)

OR

(b) A load (50 – j 100) ohms is connected across a 50 ohms line. Design a short circuited Stub to provide matching between the two at a signal frequency of 30 MHz using Smith chart. (16)

14. (a) (i) Derive the design equations of a constant k low pass filter. (8)

(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 ? (8)

OR

(b) Design a low pass composite filter to meet the following specifications $f_c = 2000$ Hz, $f_\infty = 2050$ Hz, $R_k = 500$ ohms. (16)

15. (a) Derive the field component of a Transverse Electric wave in Rectangular wave guides. (16)

OR

(b) For a frequency of 10 GHz and plane separation of 5 cm in air, find the cut off frequency, cut off wavelength, phase velocity and group velocity of the wave. (16)

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Reg. No. :

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 600 Ω. 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 exit.

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 × 10^{-6} mhos/km, C = 0.0083 μF/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 50 Ω. The line is of length (1.185 λ) and is terminated in a load of (110 + j80) Ω. (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 600 Ω and terminated in 1800 Ω. (8)

(ii) Explain the operation of quarter wave transformer and mention it's important applications. (8)

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 + j75 Ω 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 700 Ω. 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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Reg. No. :

Question Paper Code : 50445

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fifth Semester
Electronics and Communication Engineering
EC 6503 – TRANSMISSION LINES AND WAVE GUIDES
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Note : Use Smith chart wherever necessary

Answer ALL questions

PART – A (10×2=20 Marks)

1. Define characteristic impedance.
2. State the condition for a distortion less line.
3. Why is a quarter wave line called an impedance inverter ?
4. What is an impedance matching in stub ?
5. What is the nature and value of Z_0 for the dissipation less line ?
6. What are nodes and antinodes on a line ?
7. Define – Decibel.
8. What are called constant–k filters ?
9. What is dominant mode ?
10. Write the expression for cutoff wavelength of the wave which is propagated in between two parallel planes.

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) Derive the input impedance Z_0 from the transmission line equation and also find voltage reflection ratio at the load. (13)

12. a) Calculate the average input power at a distance from the load 'ℓ' and find the impedance when the load is short circuited, open circuited and for a matched line. (13)

(OR)

b) i) A 30 m long lossless transmission line with $Z_0 = 50\Omega$ operating at 2 MHZ is terminated with a load $Z_L = 60 + j40$. If $u = 0.6c$ (c is velocity of light, u is phase velocity) on the line, find

a) The reflection coefficient Γ. (2)

b) The standing wave ratio s. (2)

c) The input impedance. (3)

ii) Draw the input impedance pattern for a lossless line when short circuited and open circuited. (6)

13. a) Antenna with impedance $40 + j\,30\,\Omega$ is to be matched to a $100\,\Omega$ lossless line with a shorted stub. Determine the following using Smith chart. (13)

a) The required stub admittance.

b) The distance between the stub and the antenna.

c) The stub length.

d) The standing wave ratio on each of the system.

(OR)

b) Design a double-stub shunt tuner to match a load impedance $Z_L = 60 - j80\Omega$ to a 50Ω line. The stubs are to be short-circuited stubs and are spaced $\lambda/8$ apart. Find the lengths of the two stubs using Smith chart. (13)

14. a) Sketch the reactance curve and derive the steps to design a constant – K low pass filter. Determine attenuation constant and phase constant in pass band and stop band and plot it. (13)

(OR)

b) Design a m-derived T type low pass filter connected to a load of 500Ω with cutoff frequency 4 KHZ and peak attenuation at 4.15 KHZ. (13)

15. a) Derive the field equations of TE waves travelling in Z direction in a rectangular wave guide. (13)

(OR)

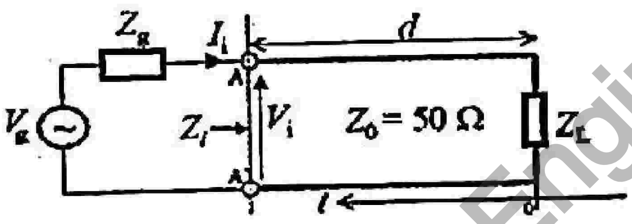
b) An air filled resonant cavity with dimensions a = 5 cm, b = 4 cm and c = 10 cm is made of copper ($\sigma_c = 5.8 \times 10^7$ mhos/m). Find the resonant frequencies of

a) The five lowest order modes. (7)

b) The quality factor TE_{101} mode. (6)

PART – C (1×15=15 Marks)

16. a) A lossless transmission line with $Z_0 = 50\Omega$ and d = 1.5 m connects a voltage Vg source to a terminal load of $Z_L = 50 + j50\Omega$. If Vg = 60 v, operating frequency f = 100 MHz and $Zg = 50\Omega$, find the distance of the first voltage maximum ℓ_M from the load and what is the power delivered to the load P_L? Assume the speed of the wave along the transmission line equal to speed of light C. (15)



(OR)

b) Examine the effectiveness of Bessel's differential equation and Bessel function with reference to waveguides. (15)

Reg. No. :

Question Paper Code : 40963

10/05/18 (FN)

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Fifth Semester
Electronics and Communication Engineering
EC 6503 – TRANSMISSION LINES AND WAVE GUIDES
(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Use (smith chart is to be provided)

Answer ALL questions

PART – A (10×2=20 Marks)

1. What is meant by distortion less line ?
2. Define reflection loss.
3. What are assumption to simply the analysis of line performance at high frequencies ?
4. Write the expression for the input impedance of open and short circuited, dissipation less line.
5. What is an impedance matching in stub ?
6. What are the uses of smith chart ?
7. What are the major draw backs of a constant – k prototype filter ?
8. Define propagation constant in a symmetrical network.
9. What is dominant mode ?
10. What are the applications of cavity resonators ?

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) A communication line has L = 3.67 mH/km, G = 0.08 × 10^{-6} ℧/km, C = 0.0083 μF/km and R = 10.4 Ω/km. Determine the characteristic impedance, phase constant, velocity of propagation, wavelength, sending end current and receiving end current forgiven frequency f = 1000 Hz, sending end voltage is 1 volt and transmission line length is 100 kilometers. **(13)**

40963

12. a) i) Derive the line constants of a zero dissipation less line. **(6)**

ii) Describe an experimental setup for the determination of VSWR of an RF transmission. **(7)**

(OR)

b) i) Briefly explain on :

a) Standing wave. **(3)**

b) Reflection loss. **(3)**

ii) Discuss in detail about the variation of input impedance along open and short circuit lines with relevant graphs. **(7)**

13. a) i) Prove that input impedance of a quarter wave line is $Z_{in} = R_0^2/Z_R$. **(6)**

ii) Design a quarter wave transformer to match a load a 200 Ω to a source resistance of 500 Ω. Operating frequency is 200 MHz. **(7)**

(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 + j75) Ω length of the line is 1.183 wavelength 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) Derive an expression for the transmission of TM waves between parallel perfectly conducting planes for the field components. **(13)**

(OR)

b) An air filled circular wavegide having an inner radius of 1 cm is excited in dominant mode at 10 GHz. Find (a) The cut-off frequency of the dominant mode at 10 GHz. (b) The guide wavelength and (c) Wave impedance. Also find the bandwidth for operation in the dominant mode only. **(13)**

PART – C **(1×15=15 Marks)**

16. a) With neat diagram, explain the single stub and double stub matching network. Also explain the design procedure. **(15)**

(OR)

b) i) Explain the wave behaviour in a guiding structures. **(10)**

ii) Explain why TEM waves does not exist in waveguides. **(5)**

29/11/18 FN

Reg. No. :

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)

Reg. No. :

Question Paper Code : 91453

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Fifth Semester
Electronics and Communication Engineering
EC 6503 – TRANSMISSION LINES AND WAVE GUIDES
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What are the primary and secondary constants of a transmission line ?

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

3. Define insertion loss.

4. A transmission line has $Z_0 = 745 \angle 12°$ and is terminated as $Z_R = 100\ \Omega$. Calculate the reflection loss in dB.

5. Write down the expression to determine the length of the stub.

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

7. What are called crystal filters ?

8. Design a low pass filter T section having cut off frequency of 2 KHz to operate with a terminated load resistance of 500 Ω.

9. What is TEM wave or principal wave ?

10. An air filled resonant cavity with dimensions a = 5 cm, b = 4 cm and c = 10 cm is made of copper. Find the resonant frequency of lowest order mode.

PART – B (5×13=65 Marks)

11. a) A generator of 1V, 1000 Hz supplies power to a 100 km open wireline terminated in Z_0 and having the following parameters. R = 10.4 ohm/km, G = 0.8×10^{-6} mho/km, L = 0.00367 henry/km and C = 0.00835 μF/km. Calculate Z_0, α, λ, β, v. **(13)**

(OR)

b) The characteristic impedance of a uniform transmission line is 2000 Ω at a frequency of 1000 Hz. At this frequency the propagation constant was found to be 0.054 ∠ 60°. Determine the values of line constants. **(13)**

12. a) Explain the parameters of open-wire and co-axial lines at radio frequency. **(7+6=13)**

(OR)

b) The terminating load of UHF transmission line working at 300 MHz is (50 + j50) Ω. Calculate VSWR and the position of the voltage minimum nearest to the load if the characteristic impedance of the line is 50 Ω. **(13)**

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

(OR)

b) A single stub is to match a 400 Ω line to a load of (200 – j100) Ω. The wavelength is 3m. Determine the position and length of the short circuited stub. **(13)**

14. a) Derive the relevant equations of m derived low pass filter and design a m derived T type low pass filter to work into the load of 600 Ω and cut off frequency at 5 KHz and peak attenuation at $1.25f_c$. **(6+7)**

(OR)

b) Explain the structure and application of crystal filter. 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 ? **(3+3+3+4=13)**

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

(OR)

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

PART – C **(1×15=15 Marks)**

16. a) A TE10 wave at 10 GHz propagates in a brass $\sigma_c = 1.57 \times 107$(S/m) rectangular waveguide 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 :

1) the phase constant,
2) the guide wavelength,
3) the phase velocity,
4) the wave impedance,
5) the attenuation constant due to loss in the dielectric and,
6) the attenuation constant due to loss in the guide walls. **(15)**

(OR)

b) i) Discuss in detail about the variation of input impedance along open and short circuited lines with relevant graphs. **(10)**

ii) A lossless line has a standing wave ratio of 4. The R_0 is 150 Ω and the maximum voltage measured in the line is 135V. Find the power delivered to the load. **(5)**

Reg. No. :

Question Paper Code : X 67563

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth Semester
Electronics and Communication Engineering
EC 1303 – TRANSMISSION LINES AND WAVEGUIDES
(Regulations 2008)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. What are the conditions for a perfect line ? What is a flat line ?

2. Give the relationship between the input impedance and characteristic impedance of an infinite line.

3. Define standing wave ratio.

4. Calculate the characteristic impedance of a quarter wave transformer to match a load of 100 Ω to a source of 250 Ω.

5. Write the expression for the characteristic wave impedance for the TE and TM waves between parallel planes.

6. A 6 GHz signal propagates between parallel planes with separation of 3 cm. Find the group velocity for the dominant mode.

7. Mention the characteristics of TEM waves.

8. Determine the characteristic impedance of TM_{11} mode in a rectangular waveguide with a = 9 cm and b = 4.5 cm at 3 GHz.

9. What are the disadvantages of circular waveguides ?

10. Mention the applications of cavity resonators.

PART – B **(5×16=80 Marks)**

11\. a) i) Derive expressions for the input and transfer impedances of a transmission line. **(12)**

ii) An open wire transmission line has R = 10 Ω/km, L = 0.0037 H/km, G = 0.4×10^{-6} mhos/km and C = 0.0083×10^{-6} F/km. Determine the attenuation and phase constants at a frequency of 1000 Hz. **(4)**

(OR)

b) i) What are the types of waveform distortion in a transmission line ? Derive the condition for the distortionless operation of a transmission line. **(12)**

ii) A lossless transmission line of length 0.434 λ and characteristic impedance 100 Ω is terminated in an impedance of (260 +180) Ω. Find the voltage reflection coefficient and SWR. **(4)**

12\. a) i) Explain the technique of double stub matching with necessary diagrams and equations. **(8)**

ii) The VSWR measured on a line at 300 MHz is 2. If the distance between the load and voltage minimum is 0.8 m, calculate the value of normalized load impedance. **(8)**

(OR)

b) i) Determine the input impedance and SWR for a transmission line 1.25 λ long with a characteristic impedance of 50 Ω and a load impedance of (30 + j40) Ω using the Smith chart. **(8)**

ii) A single short circuited stub is to match a 40 Ω line to a load of (200 – j 100) Ω. The wavelength is 3m. Find the position and length of the stub required to match the line using relevant formulas. **(8)**

13\. a) i) Explain the attenuation of TE waves guided between parallel conducting planes. **(10)**

ii) A pair perfectly conducting planes is separated by 8 cm in air. For a frequency of 5 GHz with TE_{10} mode excited, find the cut-off frequency, characteristic impedance, phase and group velocities. **(6)**

(OR)

b) Deduce the expressions of electric and magnetic fields of TM waves guided between parallel planes.

14. a) i) Find the broad wall dimension of a rectangular waveguides when the cut-off frequency for TE_{10} modes (1) 3GHz (2) 30GHz. **(6)**

ii) Prove that TEM wave does not exist in hollow waveguides. **(5)**

iii) Explain how various modes can be excited in a rectangular waveguide. **(5)**

(OR)

b) i) A hollow rectangular waveguide operates at f = 1GHZ and it has the dimensions of 5 × 2 cm. Check whether TE_{21} mode propagates or not. **(6)**

ii) Derive the expressions for the field components of TE_{10} waves in a rectangular waveguide. Sketch the field distributions. **(10)**

15. a) Discuss the propagation of TE and TM waves in a circular waveguide with relevant expressions and diagrams for the field components. **(16)**

(OR)

b) Explain the principle and operation of circular and semicircular cavity resonators and also discuss the Q factor of cavity resonators. **(16)**

Reg. No. :

Question Paper Code : X 20451

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
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 Standing Wave Ratio.
4. A lossless line has a characteristic impedance of 400 Ω. Determine the standing wave ratio if the receiving end impedance is 800 + j0.0 Ω.
5. What is an impedance matching in stub ?
6. What are the uses of Smith Chart ?
7. Determine the value of L required by a constant-K T-section high pass filter with a cut off frequency of 1 KHz and design impedance of 600 Ω.
8. What are the advantages of m-derived filters ?
9. Justify, why TM_{01} and TM_{10} modes in a rectangular waveguide do not exit.
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 (5×13=65 Marks)

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

(OR)

b) A communication line has $L = 3.67$ mH/km, $G = 0.08 \times 10^{-6}$ ℧/km, $C = 0.0083$ μF/km and $R = 10.4$ Ω/km. Determine the characteristic impedance, phase constant, velocity of propagation, wavelength, 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. **(13)**

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'. **(6)**

ii) Find the sending end line impedance for a HF line having characteristic impedance of 50 Ω. The line is of length (1.185λ) and is terminated in a load of (110 + j80) Ω. **(7)**

(OR)

b) i) Describe an experimental set up for the determination of VSWR of an RF transmission. **(7)**

ii) Briefly explain on :

1) Standing waves **(3)**

2) Reflection loss. **(3)**

13. a) A 300 Ω transmission line is connected to a load impedance of 450- j600 Ω at 10 MHz. Find the position and length of a short circuited stub required to match the line using Smith Chart.

(OR)

b) i) A load impedance of 90-j50 Ω is to be matched to a line of 50 Ω using single stub matching. Find the length and position of the stub. **(9)**

ii) Design a quarter wave transformer to match a load of 200 Ω to a source resistance of 500 Ω. The operating frequency is 200 MHz. **(4)**

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) A rectangular air-filled copper waveguide with dimension 0.9 inch × 0.4 inch cross section and 12 inch length is operated at 9.2 GHz with a dominant mode. Find cut-off frequency, guide wave-length, phase velocity, characteristics impedance and the loss.

(OR)

b) i) Using Bessel function derive the TE wave components in circular wave guides. **(7)**

ii) Calculate the resonant frequency of an air filled rectangular resonator of dimensions a = 2 cm, b = 4 cm and d = 6 cm operating in TE_{101} mode. **(6)**

PART – C **(1×15=15 Marks)**

16. a) Derive the field component of a Transverse Electric wave in rectangular wave guides. **(15)**

(OR)

b) For a frequency of 10 GHz and plane separation of 5 cm in air, find the cut off frequency, cut off wavelength, phase velocity and group velocity of the wave. **(15)**

Reg. No. :

Question Paper Code : X10369

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2021

Sixth Semester

EC8651 – TRANSMISSION LINES AND RF SYSTEMS

(Common to : Electronics and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Smith Charts to be supplied

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define characteristic impedance. What determines the characteristic impedance of a transmission line ?

2. A 50Ω line is terminated into an infinite line. If it is fed by a 10V, 50Ω source, find the reflected and power transmitted into infinite line.

3. A λ/8 transmission line is terminated by 25 + j50Ω. If the characteristic impedance of the line is 100 Ω. Find input impedance of the line.

4. A 50Ω line operating at 1 GHz is terminated by a load of 20Ω. Find the values of maximum and minimum impedance and their location on the line.

5. What is the outer circle present on the smith chart ? One complete revolution around a Smith chart represents how many wavelengths ?

6. Mention the two applications of quarter wave transmission line.

7. Define group and phase velocity.

8. A waveguide is generally operated at $f = 1.5\ f_c$ where f_c is the cutoff frequency. Assuming that the broader dimension is twice the other dimension in a rectangular waveguide, calculate the dimension if it operates in TE_{10} mode at 6 GHz.

9. Define the condition for stability in circuit design.

10. Mention the requirements and applications of low noise amplifiers.

PART – B **(5×13=65 Marks)**

11. a) Define wave form distortion on a transmission line. Determine the condition for distortion less transmission line. How can a transmission line be made distortion less ?

(OR)

b) A 50Ω line is matched to a 10 V source and feeds a load of 100Ω. If the line is 2.3λ long, λ being the wavelength and has an attenuation α = 0.5 dB/λ, find the power delivered to the load.

12. a) Define input impedance of a transmission line. A lossless transmission line of length 1 meter and characteristic impedance 100Ω is terminated in a load $Z_L = 100 - j200\ \Omega$. Determine the line impedance at a distance of 25 cm from the load if it is fed by a matched source operating at 10 MHz.

(OR)

b) Define Reflection coefficient and VSWR. A 100Ω line is terminated in a load 50 + j1000 Ω. If the line is 0.4λ find the reflection coefficient at the load, reflection coefficient at the input and VSWR.

13. a) Describe quarter wave transmission line. Discuss the applications of quarter wave transmission line.

(OR)

b) An antenna, as load on a transmission line, produces a standing wave ratio of 3, with a voltage minimum of 0.12λ from antenna terminals. Find the antenna impedance and reflection factor at the antenna, if R_o is 300 ohms on the line (Use smith chart).

14. a) Discuss the propagation of Transverse Electric waves between parallel plates.

(OR)

b) Determine possible modes of propagation for a rectangular waveguide of dimensions 7 cm × 3.1 cm at a frequency of 12 GHz.

15. a) Explain the power amplifiers used at RF frequencies.

(OR)

b) Explain the working of FET at RF frequencies.

PART – C (1×15=15 Marks)

16. a) A line of Ro = 300 ohms is connected to a load of 73 ohms. For a frequency of 45 MHz, find the length and location of a single stub nearest the load to produce an impedance match using Smith chart.

(OR)

b) A rectangular waveguide is to be designed to operate at a frequency 10 GHz. It is desired that the frequency of operation be 15% above the cutoff frequency of the operating frequency and 20% below the cutoff frequency of the next higher mode, determine the dimensions of the waveguide. Determine the propagation constant, phase velocity and group velocity at 10 GHz. Represent the Electric and Magnetic field distribution at 10 GHz in the waveguide.

Reg. No. :

Question Paper Code : 86571

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

Fifth Semester

Electronics and Communication Engineering

EC 1303 — TRANSMISSION LINES AND WAVEGUIDES

(Regulations 2008)

Time : Three hours Maximum : 100 marks

(Smith Chart is to be provided)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Determine the characteristics impedance of a coaxial cable operating at extremely high frequencies with L = 483.12 nH/m and C = 24.15 pF/m.

2. Write the equations for the characteristics impedance and propagation constant of a telephone cable.

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. Give the applications of $\lambda/8$ and $\lambda/4$ lines.

5. Assume a wave is propagates in a parallel plane waveguide. The frequency of the wave is 6000 MHz and the plane separation is 7cm. Calculate the cutoff wavelength of the dominant mode.

6. Define TEM waves.

7. What do you meant by Dominant Mode?

8. Define wave impedance of a wave guide.

9. What are the disadvantages if the resonator is made using lumped elements at high frequencies?

10. Why is TM01 mode preferred to the TE01 mode in a circular waveguide?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Derive the transmission line differential equations and obtain the general solutions for the voltage and current on the transmission line. (10)

(ii) The attenuation on a 50 Ω distortionless line is 0.01 dB/m. The line has a capacitance of 0.1 nF/m. Determine the resistance, inductance and conductance of the line. (6)

Or

(b) (i) Derive expression for the attenuation constant (α) and phase constant (β) of a transmission line in terms of R, L, G and C. (8)

(ii) A transmission line has R = 6 Ω/km, L= 2.2 mH/km, C = 0.005 μF km and G = 0.05 micromho/km. Determine the characteristic impedance, attenuation and phase constants at KHz. (8)

12. (a) (i) Design a single stub matching Network for the following Data (use SMITH CHART)

$Z_L \rightarrow$ load impedance = 400 + j200 Ω

$Z_o \rightarrow$ characteristic impedance = 300 Ω.

Use short circuited shunt stubs. Specify the VSWR values before and after the connection of stubs. (8)

(ii) Sketch the input impedance variation and standing wave pattern when a transmission line is terminated in a (8)

(1) Short circuit

(2) Open circuit.

Or

(b) Design a double stub matching Network for the following data. Normalised value of load admittance $y_l = 1.23 - j0.51$. Distance between the stubs is 0.4λ and distance from load to first stub is 0.1λ. Use shunt stubs which are short circuited at the far end. Indicate the forbidden regions (use SMITH CHART).

13. (a) Explain the transmission of TM waves between parallel planes with necessary equations. Discuss the characteristics of TE and TM waves between parallel planes. (16)

Or

(b) (i) Explain briefly the attenuation of TE and TM waves between parallel planes with necessary expressions and diagrams. (10)

(ii) Discuss the velocity of propagation and wave impedances of different modes propagating between parallel planes (6)

14. (a) Deduce the expressions of electric and magnetic fields of TE waves guided along a rectangular Waveguide.

Or

(b) (i) Write short notes on Wave impedance of TE and TM waves in rectangular wave guides. (10)

(ii) Calculate the cut-off frequency for a $TE_{1,0}$ wave in air in a rectangular waveguide measuring 5 cm by 2.5 cm. Also calculate the phase and group velocities at a frequency of 6 GHz. (6)

15. (a) (i) A copper walled rectangular cavity resonator is structured by $3 \times 1 \times 4$ cm and operates at the dominant modes of TE and TM. Find the resonant frequency and quality factor. The conductivity of copper is 5.8×10^7 mho/m. There is air inside the cavity. (8)

(ii) Derive the expressions for the field components of TM waves in a circular waveguide. (8)

Or

(b) (i) Derive the expressions for the resonant frequencies of TE and TM waves in a circular cavity resonator. (8)

(ii) Determine the size of a circular waveguide required to propagate TE11 mode if $\lambda_c = 8$ cm$(\rho_{11} = 1.841)$. (3)

(iii) Derive an expression for the quality factor Q of microwave cavities. (5)

Reg. No. :

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 ($R=2.59 \times 10^{-3}\ \Omega/m$), Series inductance ($L=2\mu H/m$), Shunt conductance ($G=0$ ℧/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 $Z_L = 115 - j80\Omega$ 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 × 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)

Reg. No. :

Question Paper Code : 20478

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Sixth Semester

Electronics and Communication Engineering

EC 8651 – TRANSMISSION LINES AND RF SYSTEMS

(Common to Electronics and Telecommunication Engineering)

(Smith Chart is permitted)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define characteristic impedance.

2. What is meant by loading of transmission line?

3. An open circuited loss less transmission line has $Z_o = 100\Omega$ is of length $\lambda/8$. Find the input impedance.

4. A transmission line of characteristic impedance 50 ohms is terminated by 150+j50 ohms impedance. Determine the reflection coefficient at the load and VSWR along the transmission line.

5. Represent the variation of impedance of short circuit transmission for a distance of one wavelength.

6. List the applications of smith chart.

7. Define cut off frequency and cut off wavelength of modes of propagation in rectangular waveguides.

8. Represent the field distribution of dominant mode in parallel plates.

9. Differentiate between PN junction and Schottky contact.

10. Define intermodulation distortion.

PART B — ($5 \times 13 = 65$ marks)

11. (a) What are the salient aspects of primary constants of a two wire transmission line? Determine the voltage and current expressions of two wire transmission line.

Or

(b) Define wave form distortion. A transmission line is to have no distortion with the following parameters: $R = 20$ ohms/km, $G = 5 \times 10^{-6}$ mho/km, $C = 0.005\ \mu F/Km$. Determine Series Inductance to be added to make the line distortion less and find the velocity and phase constant of the line at 20MHz.

12. (a) Discuss $\lambda/2$ and $\lambda/4$ length transmission lines and list its applications.

Or

(b) Distinguish between lossless and distortion less transmission lines.

13. (a) A line of $R_0 = 300$ ohms is connected to a load of 50 ohms resistance. For a frequency of 50 Hz, find the length, termination of single stub nearest to the load to produce an impedance match. (Use smith chart)

Or

(b) Discuss the double stub matching of a transmission line.

14. (a) A waveguide with parallel-plates separated by 1cm is filled with a dielectric with relative permittivity 2 and operates at 12GHz.

Determine:

(i) cutoff frequency

(ii) the phase constant (β)

(iii) the phase velocity

For the first five modes.

Or

(b) Discuss the propagation of TE waves between parallel planes and derive the expressions for electric and magnetic fields.

15. (a) Explain the design of Power amplifiers.

Or

(b) Explain the principle and working of RF field effect transistor.

PART C — ($1 \times 15 = 15$ marks)

16. (a) A generator of 1 volt and 1 MHz frequency is connected to a transmission line which has series impedance of 20+j25 ohms/Km and shunt admittance of $(3+j5)\times 10^{-6}$ ohms/Km. Find the characteristic impedance and propagation constant. Find the current, voltage along the transmission line at a distance of 10km.

Or

(b) An antenna as a load on a transmission line produces a standing wave ratio of 2.8, with a voltage minimum 0.1 λ from the antenna terminals. Find the antenna impedance and the reflection factor `K' at the antenna if R_o=300 ohms for the line.

Reg. No. :

Question Paper Code : 90481

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Electronics and Communication Engineering

EC 8651 — TRANSMISSION LINES AND RF SYSTEMS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define reflection factor and return loss.

2. Why loading of transmission line is done?

3. A loss less transmission line has L=2mH and C=8nf. Find the characteristic impedance and propagation constant at a frequency of 10 MHz.

4. A transmission line of characteristic impedance 75 ohms is terminated by resistance which has VSWR of 3. Find reflection coefficient at the load and load resistance.

5. Calculate the length of short circuit line to give an impedance of +j 20 ohms. The characteristic impedance of the line is 100 ohms.

6. A certain line of R_o=100 ohms is short at the termination. Find the impedance seen by the generator connected at a point $\frac{\lambda}{2}$.

7. What is dominant mode of propagation for rectangular waveguide?

8. A parallel plane guide having distance between them as 4 cm is filled with dielectric material with dielectric constant of 2. Find the cut off frequency, for TM_{11} mode.

9. Define cutoff frequency of microwave transistor.

10. Define stability of power amplifier.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Define transmission line parameters. Derive the transmission line equations from the equivalent circuit representation.

Or

(b) A generator of 2 volt and 10 MHz frequency is connected to a transmission line which has series impedance of 50+j50 ohms/km and shunt admittance of $(2+j4) \times 10^{-6}$ ohms/km. Find the characteristic impedance and propagation constant. Find the power delivered to the load impedance of impedance 100+j 100 ohms.

12. (a) Define the reflection coefficient and voltage standing wave ratio and draw the voltage and current waveforms when the transmission line is terminated by matched load, short circuit, open circuit and reactance terminations.

Or

(b) Find the required value of Zo of the transmission line of length $\beta l = \pi/2$ that will match 10 ohms load resistance to the generator. The generator internal resistance is 200 ohms. Find the VSWR and reflection coefficient on the line.

13. (a) A line of $R_o = 300$ ohms is connected to a load of 80 ohms resistance. For a frequency of 1MHz, find the length, termination of single stub nearest to the load to produce an impedance match. (Use smith chart).

Or

(b) Explain single stub matching of transmission line and derive the expressions.

14. (a) Discuss the characteristics: cut off frequency, cut off wave length, phase velocity, wave length, group velocity, and wave impedance for TE, TM and TEM waves between two conducting planes.

Or

(b) Derive the field expressions for Transverse Magnetic wave in a rectangular waveguide. Draw the field distribution for the lowest order mode.

15. (a) With neat diagram explain the stability consideration in design of RF amplifiers.

Or

(b) Explain the basic concepts and design of mixer.

PART C — (1 × 15 = 15 marks)

16. (a) A line is one wave length long and is open circuited. If a supply of 1 volt amplitude and 1 kHz frequency is connected to it. Find the incident, reflected and total voltage at $\lambda/16$ distance from the short. The line parameters are R=50 ohms, L=0.001 Henry, C=0.06 μF and 0=1.5 ohms.

Or

(b) A lossless line (7/16) λ long has an input impedance $Z_s/R_0 = 1.5 + j1.5$. Find the load impedance and standing wave ratio, amplitude and phase of reflection coefficient.

Reg. No. : E N G G T R E E . C O M

Question Paper Code : 20934

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023

Fifth Semester

Electronics and Communication Engineering

EC 3551 – TRANSMISSION LINES AND RF SYSTEMS

(Common to : Electronics and Telecommunication Engineering)

(Smith Chart must be provided)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define transmission line.
2. State the properties of an infinite line.
3. Define skin effect.
4. Sketch the standing wave pattern on a line having short circuit termination.
5. Why quarter wave line is called as copper insulator?
6. Compare single stub matching and double stub matching.
7. List out the characteristics of TE waves.
8. Define wave impedance.
9. List the various types of mixers.
10. List the factors affecting amplifier performance.

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expression for the attenuation and phase constants after obtaining an expression for the characteristic impedance.

Or

(b) (i) Draw and explain the reflection loss due to mismatch between source and load impedances. (7)

(ii) Illustrate the Z_o in terms of primary constants. (6)

12. (a) Identify the general expressions for voltage and current at any point on the radio frequency dissipationless line and draw the incident and reflected voltage wave for the successive instants of time.

Or

(b) Derive the expression for the input impedance of its dissipation less line and find the maximum and minimum impedances.

13. (a) Describe the impedance matching technique using single stub and obtain the expression for the stub location and stub length.

Or

(b) VSWR of a lossless line is found to be 5 and successive voltage minima are 40 cm apart. The first voltage minima is observed to be 15 cm from the load. The length of the line is 160 cm and Z_o is 300 Ω. Apply the values in smith chart to find the load impedance and input impedance.

14. (a) Compute the field configuration, cut off frequency and velocity of propagation for TM waves in rectangular wave guides. (4+4+5)

Or

(b) A rectangular waveguide measuring a = 4.5 cm and b = 3 cm has a 9 GHz signal propagated in it. Calculate the guide wavelength, phase and group velocities for the dominant mode.

15. (a) Explain the construction and functionality of RF Field effect transistors. (6+7)

Or

(b) With reference to RF transistor amplifier, explain the considerations for stability and gain. (6+7)

PART C — (1 × 15 = 15 marks)

16. (a) Describe about the standing waves, nodes, antinodes and standing wave ratio. Obtain the relation between the standing wave ratio S and the magnitude of the reflection coefficient. (8+7)

Or

(b) State and formulate the transducer power gain, available power gain and operating power gain of a microwave amplifier in terms of S parameters and different reflection coefficient.

Reg. No. : E N G G T R E E . C O M

Question Paper Code : 50967

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fifth Semester

Electronics and Communication Engineering

EC 3551 – TRANSMISSION LINES AND RF SYSTEMS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

(Note : Smith chart can be provided on request)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Justify that a finite line terminated in its characteristic impedance behaves as an infinite line.

2. Find the input impedance of a transmission line of length $\lambda/8$, terminated with the load impedance of $40 + j20\,\Omega$. Assume $Z_0 = 50\,\Omega$.

3. What are Standing waves? When the standing wave does exists?

4. An lossless line has a characteristic impedance of $400\,\Omega$. Find the standing wave ratio with the receiving end impedance of $Z_R = 70 + j0.0\,\Omega$.

5. What is the significance of quarter wave line? Recall the equation for the input impedance?

6. Mention any two applications of smith chart.

7. Sketch the variation of attenuation with frequency for TE, TM and TEM waves.

8. Define TE, TM mode of propagation.

9. Define skin depth.

10. List the characteristic parameters of power amplifier.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Determine secondary constants for a transmission line with the following primary constants: R = 100 Ω/km, G = 15×10^{-6} mho/km, $L = 0.001\,\mu H$ / Km, $C = 0.062\,\mu F$ / Km. (6)

(ii) Discuss the two types of waveform distortion on a transmission line and obtain the condition for the distortionless line. (7)

Or

(b) Derive the expression to determine current and voltage at any point along a transmission line of length 'l', terminated with Z_0. (13)

12. (a) (i) A transmission line with a characteristic impedance of $Z_0 = 820\angle-34^\circ$ is terminated with Z_R = 100 ohm. Calculate VSWR, Reflection loss in dB and reflection coefficient. (6)

(ii) Interpret the method to measure VSWR and wavelength in a transmission line. (7)

Or

(b) (i) Determine the reflection coefficient, VSWR, and input impedance for a transmission line terminated with matched, short-circuited, and open- circuited loads. (7)

(ii) Derive the relation between a transmission line's standing wave ratio and reflection coefficient. (6)

13. (a) Using Smith chart, determine the following for a 50 Ω lossless transmission, terminated with the load of 20+j30 Ω, phase velocity = 0.5 c and frequency = 900 MHz, where c is the free space velocity.

(i) Input impedance at a distance of 5 cm from the load (3)

(ii) Input reflection coefficient at the same distance above (3)

(iii) VSWR (3)

(iv) Input and Load admittance (4)

Or

(b) Summarize the role of the Quarter wave transformer in the electric signal distribution. Also, determine the length and impedance of a quarter wave transformer that will match a 150 Ω load to a 75 Ω line at a frequency of 12 GHz. (13)

14. (a) (i) Derive the general field components of TM_{mn} waves in waveguides. (7)

(ii) Justify and explain that "TEM mode does not exist in a rectangular waveguide." (6)

Or

(b) (i) Define attenuation and prove that the frequency of minimum attenuation due to conductor loss in a parallel plate waveguide for TM waves is $\sqrt{3}\, f_c$. (7)

(ii) A resonator is filled with air with dimensions a = 4 cm, b = 3 cm, and c = 10 cm with $\sigma_c = 5.8$. Find the resonant frequency f_r and the Quality Factor, Q, of TE_{101} mode. (6)

15. (a) Summarize the steps in designing a single-stage RF amplifier with constant gain. (13)

Or

(b) Discuss the significance of filters, couplers, low-noise amplifiers and power amplifiers in the context of RF systems. (13)

PART C — (1 × 15 = 15 marks)

16. (a) An RF transmission line with a characteristic impedance of $300\angle 0^\circ\,\Omega$ terminated in an impedance of $100\angle 45^\circ\,\Omega$. This load will be matched to the transmission line using a short-circuited stub. With the help of a Smith chart, determine the stub's length and its distance from the load.

Or

(b) Obtain an expression for TE waves between parallel plates. Sketch the field distribution for electric and magnetic fields for TE_{10} mode between parallel planes.

Reg. No. : E N G G T R E E . C O M

Question Paper Code : 40988

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fifth Semester

Electronics and Communication Engineering

EC 3551 – TRANSMISSION LINES AND RF SYSTEMS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Note : Smith chart needs to be provided.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Characteristics impedance.

2. Recall the condition for distortion less transmission line.

3. What is standing wave ratio?

4. List the performance parameters of a high frequency transmission line.

5. What is the need for impedance matching?

6. Mention the applications of smith chart.

7. Define cutoff frequency of a waveguide.

8. Why does rectangular waveguides preferred over circular waveguides?

9. Distinguish between oscillator and mixer.

10. Mention the use of couplers in RF Transceivers circuits.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss in detail about inductance loading of telephone cables and recall the attenuation constant, phase constant and velocity of signal transmission for the uniformly loaded cable. (7)

(ii) Describe about the reflection on a line not terminated in its characteristic impedance. (6)

Or

(b) Obtain the general transmission line equation for the voltage and current at any point on a transmission line.

12. (a) Explain in detail about the wavelength and VSWR measurement of the transmission line.

Or

(b) Explain in detail about the input impedance of open and short circuited transmission lines.

13. (a) Explain in detail about the single stub matching using smith chart.

Or

(b) (i) Explain the operation and application of quarter wave transformer. (8)

(ii) Compare single and double stub impedance matching procedures. (5)

14. (a) Explain the propagation of electromagnetic waves between parallel plane waveguides with appropriate mathematical expressions and diagrams.

Or

(b) Describe the TM field components using Bessel equation in circular waveguides with necessary diagrams.

15. (a) Explain the construction and functionality of RF Field effect transistors.

Or

(b) Explain the following

(i) High Electron Mobility Transistor (6)

(ii) Low noise amplifiers. (7)

PART C — (1 × 15 = 15 marks)

16. (a) A 50 Ω lossless line is to be matched to a load of $Z_L = 75 + j100\,\Omega$ with a shorted shunt-stub tuner. Determine the required stub admittance, its distance from the load and stub length using smith chart. Draw the transmission line and Matching network mention its length, position in the diagram.

Or

(b) A 30 m long lossless transmission line with $Z_0 = 50\,\Omega$ operating at 2 MHz is terminated with a load $Z_L = 60 + j40\,\Omega$. If $u = 0.6\ c$ (c is velocity of light, u is phase velocity) on the line, Find the following parameters with the help of smith chart.

(i) Reflection Coefficient

(ii) Standing wave ratio

(iii) Input impedance and admittance.

(iv) Maxima and minima position from the load

(v) Load admittance.