



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**QUESTION BANK**

**SUBJECT CODE : EC1305 SEM / YEAR : V / III**

**SUBJECT NAME : TRANSMISSION LINES & WAVE GUIDES**

**UNIT I - TRANSMISSION LINE THEORY**

**PART – A**

**All questions – Two Marks:**

1. What is group velocity?
2. What is patch loading?
3. What do you understand by loading of transmission lines?
4. Define Characteristic impedance?
5. What is frequency distortion?
6. Calculate the load reflection coefficient of open and short circuited lines?
7. Calculate the characteristic impedance for the following line parameters  
 $R = 10.4 \text{ ohms /km}$        $L = 0.00367 \text{ H/km}$   
 $C = 0.00835 \mu\text{f /km}$        $G = 10.8 \times 10^{-6} \text{ mhos /km}$
8. Define phase distortion?
9. Write the equation for the input impedance of a TL?
10. Define propagation constant?
11. Define wavelength?
12. Give the input impedance of a open and short circuit line?
13. Define reflection factor?
14. Define reflection loss?
15. What is meant by reflection co – efficient?
16. State the properties of infinite line?

17. Write the condition for a distortion less line?
18. When does reflection take place on a TL?
19. What is transfer impedance? State its expression?
20. What is difference between lumped and distributed parameters?
21. Draw the equivalent circuit of a TL?
22. Write the Campbell's formula for propagation constant of a loaded line?
23. What is the need for loading?

**PART – B**

1. Obtain the general solution of Transmission line? **(16)**
2. Explain about waveform distortion and distortion less line condition? **(16)**
3. Explain about reflection loss? **(16)**
4. Discuss in details about inductance loading of telephone cables and derive the attenuation constant ( $\alpha$ ) and phase constant ( $\beta$ ) and velocity of signal transmission ( $v$ ) for the uniformly loaded cable? **(16)**
5. Derive the equation of attenuation constant and phase constant of TL in terms of R, L, C, G? **(16)**
6. Explain in details about the reflection on a line not terminated in its characteristic impedance ( $z_0$ )? **(16)**
7. Explain in following terms **(16)**
  - (i) Reflection factor
  - (ii) Reflection loss
  - (iii) Return loss
8. Explain about physical significance of TL? **(16)**
9. Derive the equation for transfer impedance? **(16)**
10. Derive the expression for input impedance of lossless line? **(16)**
11. Explain about telephone cable? **(16)**
12. Explain about different type of TL? **(16)**

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**UNIT II - THE LINE AT RADIO FREQUENCIES****PART – A****All questions – Two Marks:**

1. Name few applications of half – wave line?
2. Find the VSWR and reflection co – efficient of a perfectly matched line with no reflection from load?
3. Explain the use of quarter wave line for impedance matching?
4. What is the need for stub matching in transmission lines?
5. Why do standing waves exist on TL?
6. Define Node and antinodes?
7. What are constant S circles?
8. What are the advantages of double stub matching over single stub matching?
9. Derive the relationship between standing wave ratio and reflection co – efficient?
10. Write the expression for the characteristic impedance  $R_0'$  of the matching quarter – wave section of the line?
11. Give the applications of smith chart?
12. Define standing wave ratio?
13. Give the analytical expression for input impedance of dissipation less line?
14. Design a quarter wave transformers to match a load of  $200 \Omega$  to a source resistance of  $500 \Omega$ . The operating frequency is 200 MHz?
15. Define skin effect?
16. What is zero dissipation line?
17. Mention the assumptions of radio frequency lines?
18. Distinguish between single stub matching and double stub matching?
19. Write down the expression to determine the length of the stub?
20. Write down the expression to determine the position of the stub?

**PART – B**

1. Explain about half wave transformer? **(8)**
2. Application of smith chart? **(8)**
3. Explain about voltage and current waveform of dissipation less line? **(16)**

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4. Derive the expression for the input impedance of the dissipation less line and the expression for the input impedance of a quarter wave line. Also discuss the application of quarter wave line? **(16)**
  5. Explain single stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line? **(16)**
  6. Design a single stub match for a load of  $150 + j225$  ohms for a 75 ohms line at 500 MHz using smith chart? **(16)**
  7. A 30 m long lossless transmission line with characteristic impedance ( $Z_0$ ) of 50 ohm is terminated by a load impedance ( $Z_L$ ) =  $60 + j40$  ohm. The operating wavelength is 90 m. find the input impedance and SWR using smith chart? **(16)**
  8. Explain double stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line? **(16)**
  9. Explain about  $\lambda / 8$  wave transformer? **(16)**
  10. explain about properties of smith chart? **(16)**

### **UNIT III - GUIDED WAVES**

#### **Part-A**

#### **All questions – Two Marks:**

1. Define group velocity?
2. What are the characteristics of TEM waves?
3. What is the cut off frequency of TEM wave?
4. Give the expression that relates phase velocity ( $V_p$ ), Group velocity ( $V_g$ ) and free space velocity?
5. What are TE waves or H waves?
6. What are TM waves or E waves?
7. What are guided waves?
8. What is dominant mode? Give examples?
9. Write down the expression for cut off wavelength and cut off frequency?
10. Write down the expression for velocity of propagation?
11. Define attenuation factor?
12. Define wave impedance?
13. Distinguish between TE and TM waves?
14. Write down the relation between guide wavelengths and cut off wavelength?

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15. Give the expression for the guide wavelength when the wave transmitted in between two parallel plates?
  16. Find the frequency of minimum attenuation for TM waves?
  17. Give relation between the attenuation factor for TE and TM waves?
  18. Draw a neat sketch showing the variation in the value of attenuation with frequency for TE, TM, and TEM mode between two parallel plates?
  19. Draw a neat sketch showing the variation in the value of wave impedance with frequency for TE, TM, and TEM mode between two parallel plates?

**Part-B**

1. Discuss the characteristics of TE and TM waves and also derive the cut off frequency and phase velocity from the propagation constant? (16)
2. Derive the expression for the field strength for TE waves between parallel plates propagating in Z direction? (16)
3. Derive the expression for attenuation of TM waves in between parallel plates? (16)
4. Derive the expression for attenuation of TE waves in between parallel plates? (16)
5. Derive the expression for the field strength for TM waves between Parallel plates propagating in Z direction? (16)
6. Obtain the expression for the field components of an electromagnetic wave propagating between a pair of perfectly conducting planes? (16)
7. Derive the expression for wave impedance of TE, TM and TEM wave between a pair of perfectly conducting planes? (16)
8. Explain about transverse electromagnetic waves between a pair of perfectly conducting planes? (16)
9. Prove that the velocity of propagation? (16)

**UNIT IV - RECTANGULAR WAVEGUIDES****Part-A****All questions – Two Marks:**

1. What are the dominant mode and degenerate modes in rectangular wave – guides?
2. A rectangular wave – guides has the following values  $l=2.54$  cm,  $b= 1.27$  cm waveguide thickness = .0127. Calculate the cut off frequency?

3. Define wave impedance?
4. Why TEM mode is not possible for rectangular wave – guides?
5. Define characteristic impedance?
6. Define attenuation factor?
7. Draw a neat sketch showing the variation in the value of attenuation with frequency for TE, TM, and TEM mode for rectangular wave guide?
8. Draw a neat sketch showing the variation in the value of wave impedance with frequency for TE, TM, and TEM mode for rectangular wave guide?
9. Write down the expression for cut off wavelength and cut off frequency for rectangular wave guide?
10. Write down the expression for cut off wavelength and cut off frequency for TE 10 mode?
11. Write down the expression for guide wavelength and velocity of propagation for rectangular wave guide?
12. Write down the expression for attenuation constant for TE 10 mode?
13. Write down the expression for attenuation constant for TM 11 mode?
14. What is cut off frequency?
15. What is dominant mode? Name the dominant mode in TE and TM waves?

**Part-B**

1. Derive the field configuration, cut off frequency and velocity of propagation for TM waves in rectangular wave – guides? **(16)**
2. Determine the solution of electric and magnetic fields of TE waves guided along rectangular wave – guides? **(16)**
3. Explain the wave impedance of a rectangular wave – guide and derive the expression for the wave impedance of TE, TM, and TEM mode? **(16)**
4. Discuss the characteristics of TE and TM waves and also derive the cut off frequency and phase velocity from the propagation constant? **(16)**
5. Derive the expression for attenuation of TE<sub>10</sub> waves in rectangular wave guide? **(16)**
6. Derive the expression for attenuation of TM<sub>11</sub> waves in rectangular wave guide? **(16)**
7. Explain about excitation modes in rectangular wave guide? **(16)**
8. Explain about dominant mode in rectangular wave guide? **(16)**

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9. Determine the solution of electric and magnetic fields of TM waves guided along rectangular wave – guides? (16)
  10. Explain about characteristic impedance in rectangular wave guide? (16)
  11. Explain about degenerate mode in rectangular wave guide? (16)

## UNIT V - CIRCULAR WAVE GUIDES AND RESONATORS

### Part-A

#### All questions – Two Marks:

1. What is cavity resonator?
2. Define the quality factor of the cavity resonator?
3. Define loaded and un loaded Q cavity resonator?
4. Give the application of circular wave guide?
5. Why rectangular or circular cavities can be used as microwave resonators?
6. Define Bessel's function?
7. What is Eigen value?
8. What is dominant mode of TM and TE waves in circular waveguide?
9. Write expressions for the Eigen value and cut off wave number for the TE mode?
10. Write expressions for the Eigen value and cut off wave number for the TM mode?
11. Expression for the resonant frequency of the rectangular cavity resonator?
12. Expression for the resonant frequency of the circular cavity resonator?
13. Expression for the quality factor of the circular cavity resonator?
14. Expression for the quality factor of the rectangular cavity resonator?
15. Define cavity tuning?
16. Define resonant cavity?
17. Give the application of microwave resonator?

#### Part-B

1. Derive the Q-factor of a rectangular cavity resonator? (16)
2. Derive the TM wave components in circular wave guides using Bessel functions? (16)
3. What is meant by cavity resonator? Derive the expression for the resonant frequency of the rectangular cavity resonator? (16)

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4. Derive the expression for cut off frequency, phase constant and phase velocity of wave in a circular wave guide? (16)
  5. Derive the expression for the resonant frequency of the circular cavity resonator? (16)
  6. Derive the expression for the resonant frequency of the semi circular cavity resonator? (16)
  7. Derive the TE wave components in circular wave guides using Bessel functions?(16)
  8. Derive the expression for the wave impedance in circular wave guide? (16)
  9. Derive the field strength or equation in cylindrical co – ordinates systems? (16)

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