SRI VIDYA COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EC6503-TRANSMISSION LINES AND WAVE GUIDES

2 MARKS & 16 MARKS

UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES

1. What is Impedance matching?

If the load impedance is not equal to the source impedance, then all the power that are transmitted from the source will not reach the load end and hence some power is wasted. This is called impedance mismatch condition. So for proper maximum power transfer, the impedances in the sending and receiving end are matched. This is called impedance matching.

2. Why is a quarter wave lines called as impedance inverter?

A quarter wave line may be considered as an impendence inverter because it can transform a low impendence in to ahigh impendence and vice versa.
48. What is the application of the quarter wave matching section ?
An important application of the quarter wave matching sectionis to a couple a transmission line to a resistive load such as an antenna .The quarter .wave matching section then must be designed to have a characteristic impendence Ro so chosen that the antenna resistance Ra is transformed to a value equal to the characteristic impendence Ra of the transmission line

3. Explain impedance matching using stub.

In the method of impendence matching using stub, an open or closed stub line of suitable length is used as a reactance shunted across the transmission line at a designated distance from the load ,to tune the length of the line and the load to resonance with an antiresonant resistance equal to Ro.

4.Give reasons for preferring a short- circuited stub when compared to an open circuited stub.

A short circuited stub is preferred to an open circuited stub because of greater ease in constructions and because of the inability to maintain high enough insulation resistance at the open .circuit point to ensure that the stub is really open circuited. A shorted stub also has a lower loss of energy due to radiation ,since the short . circuit can be definitely established with a large

metal plate ,effectively stopping all field propagation.

5. What is the use of a circle diagram?

The circle diagram may be used to find the input impendence of a line m of any chosen length.

6. List the applications of the smith chart.

The applications of the smith chart are,
(i) It is used to find the input impendence and input admittance of the line.
(ii) The smith chart may also be used for lossy lines and the locus of points on a line then follows a spiral path towards the chart center, due to attenuation.
(iii) In single stub matching

7. What is the use of eighth wave line?

An eighth wave line is used to transform any resistance to an impendence with a magnitude equal to Roof the line or to obtain a magnitude match between a resistance of any value and a source of Ro internal resistance.

8. What is double stub matching?

Another possible method of impedance matching is to use two stubs in which the locations of the stub are arbitrary,the two stub lengths furnishing the required adjustments.The spacing is frequently made λ/4.This is called double stub matching.

9. Give reason for an open line not frequently employed for impedance matching.

An open line is rarely used for impedance matching because of radiation losses from the open end,and capacitance effects and the difficulty of a smooth adjustment of length.

10. Give the input impendence of eighth wave line terminated in a pure resistance Rr.

The input impendence of eighth wave line terminated in a pure resistance Rr. Is given by

$$Zs = (Z_R + jRo/Ro + jZ_R)$$

From the above equation it is seen that

$$Zs = Ro.$$

11. What is a transmission line?

It means of transfer of information from one point to another. Usually it consists of two

conductors. It is used to connect a source to a load. The source may be a transmitter and the load may be a receiver.

12. Mention the types of transmission lines.

- Two – wire parallel lines
- Coaxial lines
- Twisted wires
- Parallel plates or planar lines
- Wire above conducting line
- Microstrip lines
- Optical fibres

13. List out the applications of transmission lines.

- They are used to transfer energy from one circuit to another.
- They can be used as a circuit elements such as inductors, capacitors etc.
- They can be used as impedance matching devices.
- They can be used as stubs.

14. Give some of the impedance matching devices.

The quarter wave line transformer and the tapered line are some of the impendence matching devices.

15. List the applications of the smith chart.

- Smith chart as an admittance diagram
- Converting impedance into admittance
- Determination of an input impedance
- Determination of an load impedance

16. What is smith chart?

Resistive component R and reactive component X of an impedance has been represented in a rectangular form while in smith chart R and X are represented in circular form. It is referred as smith chart.

17. What is an infinite line?

An infinite line is a line in which the length of the transmission line is infinite. A finite line, which is terminated in its characteristic impedance, is termed as infinite line. So for an infinite line, the input impedance is equivalent to the characteristic impedance.

18. What are the difficulties in single stub matching?

The difficulties of the smith chart are

(i) Single stub impedance matching requires the stub to be located at a definite point on the line. This requirement frequently calls for placement of the stub at an undesirable place from a mechanical view point.

(ii) For a coaxial line, it is not possible to determine the location of a voltage minimum without a slotted line section, so that placement of a stub at the exact required point is difficult.

(iii) In the case of the single stub it was mentioned that two adjustments were required, these being location and length of the stub.

19. Why Double stub matching is preferred over single stub matching.

Double stub matching is preferred over single stub due to following disadvantages of single stub.

1. Single stub matching is useful for a fixed frequency. So as frequency changes the location of single stub will have to be changed.
2. The single stub matching system is based on the measurement of voltage minimum .Hence for coaxial line it is very difficult to get such voltage minimum, without using slotted line section.

20. What is the application of the quarter wave matching section ?

An important application of the quarter wave matching section is to a couple a transmission line to a resistive load such as an antenna .The quarter –wave matching section then must be designed to have a characteristic impendence Ro so chosen that the antenna resistance Ra is transformed to a value equal to the characteristic impendence Ra of the transmission line. The characteristic impendence Ro of the matching section then should be

$$Ro' = \sqrt{Ra\ Ro}$$

16 MARKS:

1. Explain single stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line?

2. Design a single stub match for a load of 150+j225 ohms for a 75 ohms line at 500 MHz using smith chart?

3. A 30 m long lossless transmission line with characteristic impedance (Zo) of 50 ohm is terminated by a load impedance (ZL) = 60 + j40 ohm. The operating wavelength is 90 m. find the input impedance and SWR using smith chart?

4. Explain double stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line?

5. Explain about $\lambda / 8$ wave transformer?

6. Explain about properties of smith chart?

7.Consider the line with Zo=100Ω terminated by an unknown impedance.The SWR =2.5 and first voltage minimum at 16cm from termination.when the frequency is 100 MHz.Determine the terminating impedance by use of Smith Chart assuming the Line is placed in free space.

8. Application of smith chart?

9. Write short notes on quarter wave line and write its applications.

10.Explain in detail about single stub matching and double stub matching.