SRI VIDYA COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EC6503-TRANSMISSION LINES AND WAVE GUIDES

2 MARKS & 16 MARKS

UNIT II HIGH FREQUENCY TRANSMISSION LINES

1. What is dissipationless line?

A line for which the effect of resistance R is completely neglected is called dissipationless line.

2.What are nodes and antinodes on a line?

The points along the line where magnitude of voltage or current is zero are called nodes while the the points along the lines where magnitude of voltage or current first maximum are called antinodes or loops.

3.What is standing wave ratio?

The ratio of the maximum to minimum magnitudes of voltage or current on a line having standing waves called standing waves ratio.

4.What is the range of values of standing wave ratio?

The range of values of standing wave ratio is theoretically 1 to infinity.

5.What are standing waves?

If the transmission is not terminated in its characteristic impedance ,then there will be two waves traveling along the line which gives rise to standing waves having fixed maxima and fixed minima.

6.State the values of a and b for the dissipation less line.
Answer:
$\alpha=0$ and $\beta=w\ (LC)^{1/2}$

7. How will you make standing wave measurements on coaxial lines?
For coaxial lines it is necessary to use a length of line in which a longitudinal slot, one half wavelength or more long has been cut. A wire probe is inserted into the air dielectric of the line as a pickup device, a vacuum tube voltmeter

or other detector being connected between probe and sheath as an indicator. If the meter provides linear indications, S is readily determined. If the indicator is non linear, corrections must be applied to the readings obtained

8.Why the point of voltage minimum is measured rather than voltage maximum?

The point of a voltage minimum is measured rather than a voltage maximum because it is usually possible to determine the exact point of minimum voltage with greater accuracy.

9. State the assumptions for the analysis of the performance of the radio frequency line.

1.Due to the skin effect ,the currents are assumed to flow on the surface of the conductor. The internal inductance is zero.
2.The resistance R increases with square root of f while inductance L increases with f .
Hence $\omega L >> R$.
3.The leakage conductance G is zero

10.State the expressions for inductance L of a open wire line and coaxial line.

For open wire line ,
$L=9.21*10\text{-}7(\mu/\mu r +4\ln d/a)=10\text{-}7(\mu r +9.21\log d/a)$ H/m
For coaxial line,
$L = 4.60*10\text{-}7[\log b/a]$H/m

11.State the expressions for the capacitance of a open wire line

For open wire line ,
$C=(12.07)/(\ln d/a)\mu\mu f/m$

12. Write the expressions for the input impedance of open and short circuited dissipationless line.

Ans: For a short circuited line ZR =0 ,so that $Z_{SC} = jR_0 \tan\beta s$
For a open circuited line ZR = infinite ,so that $Z_{OC} = -jR_0 \cot\beta s$

13. A lossless line has a characteristic impedance of 400 ohms. Determine the standing wave ratio if the receiving end impedance is 800 +j 0.0 ohms.

Ans: SWR = [1+ | K|] / [1- | K|]
Where K = [ZR-ZO] / [ZR+Z0]
=[800-400]/[800+400]
= [400/1200] =0.33+j0
SWR = [1+ | K|] / [1- | K|]= [1+ | 0.33|] / [1- | 0.33|]
=2.01515

14. Compute the VSWR of a 75 ohm transmission line when it is terminated by a load impedance of 50+j30 ohm [Nov-2010]

Ans:The reflection coefficient K = [ZR-ZO] / [ZR+Z0]
= [(50+j30)-75] /[50+j30)+75]
=[-25+j30] / [125+j30]
=39.05 angle of 129.80 / 128.5 angle of 13.495
= 0.303angle of 116.305
| K| =0.303
VSWR = [1+ | K|] / [1- | K|]
= [1+0.303] / [1-0.303] = 1.303/0.697
=1.8694

15. A lowlossline has a characteristic impedance of 400 ohms.Determine the standing wave ratio if the receiving end impedance is(650-j475) ohms[Nov-2009]
Ans: SWR = [1+ | K|] / [1- | K|]
K = [ZR-ZO] / [ZR+Z0]
=[**650-j475-400]/[650-j475+400] =[250-j475] / [850-j475]=0.551 -33.04**

16. If the reflection coefficient of a line is 0.3 angle of -66 degree ,calculate the standing wave ratio. [May-2009]
Ans: SWR = [1+ | K|] / [1- | K|] =[1+0.3] / [1-0.3] =1.3/0.7=13/7 =1.8

17. Give the minimum and maximum value of SWR and reflection coefficient [Nov-2008]
Ans: Minimum and maximum value of SWR is 1 to infinity
Minimum and maximum value of reflection coefficient is -1 to + 1

18. Find the VSWR and Reflection coefficient of a perfectly matched line with no reflection from load? [May-2007]
VSWR = [1+ | K|] / [1- | K|] and reflection coefficient K=0
Therefore K= [Vr /Vi]

19. **Why do standing waves exist on transmission lines?[Nov-2006][Apr-2005] [Nov-2004]**
If voltage magnitudes are measured along the length of a line terminated in a load other than R_0,the plotted values appear as shown in fig. These waves are called standing waves.

<u>16 marks</u>

1. **A lossless line in air having a characteristic impedance of 300 ohms is terminated by unknown impedance. The first voltage minimum is located at 15 cm from the load. The standing wave ratio is 3.3. Calculate the wavelength and terminating impedance.**

2.Define standing wave ratio and obtain the expression of VSWR in terms of reflection coefficient.

3.Define and explain the following
i. Standing waves iv. Nodes and antinodes
ii. Standing wave ratio v. A method to measure SWR
iii. Relation between SWR and K

4.A 30m long lossless line transmission line with characteristic impedance(z_0) of 50 ohms is terminated by a load impedance Z_l=60+j40 ohms .The operating wavelength is 90m.Find reflection coefficient, standing waves ratio and input impedance.

5. **Determine the input impedance of open and short circuited dissipation less transmission lines.**

6. Explain the condition for distortionless line.Characteristic impedance of a transmission line at 8 MHz is (4-2j)ohm and the propagation constant is (0.01+j0.18) per meter.Find the primary constants.

7. Derive the expression for the input impedance of a lossless line.

8. The input impedances of a λ/8 long,50Ω transmission line are Z_1=25+j100 ohm,Z_2=10-j50Ω,Z_3=100+j0 ohms.and Z_4=0+j50 ohms,when various load impedance and the reflection coefficient at the input and load ends.