SRM Institute of Science and Technology

Tiruchirappalli Campus, Trichy – 621 105

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

18ECC105T: ELECTROMAGNETICS AND TRANSMISSION LINES

Assignment – 03

Unit 04:

1. State and define propagation constant and draw the equivalent circuit of a transmission line.
2. Write down the condition for distortion less line, wavelength and velocity of wave.
3. A lossless line has a shunt capacitance of 70pF and a series inductance of 0.487uH. Calculate the characteristics impedance.
4. State primary, secondary constants of a transmission line and draw the equivalent circuit of a transmission line
5. Write down the condition for wavelength and velocity of wave
6. Derive the expression for general solution on a transmission line in terms of receiving end voltage and current.
7. The characteristics impedance of a uniform transmission line is 2400ohm at a frequency of 3000 MHz. At this frequency, the propagation constant is 0.056(0.0377+j1), Determine R,L,G and C.
8. Derive the expression for voltage and current at any point on a transmission line in terms of receiving end voltage and current.
9. From the general solution of the transmission line obtain the expression for Reflection coefficient and also obtain the Reflection coefficient for the following conditions
   (i) $Z_R = Z_0$
   (ii) $Z_R = 0$
   (iii) $Z_R = \infty$
10. A generator of 0.5V, 2KHz supplies power to a 200 mile open wire line terminated in 100Ω resistance. The line parameters are $R = 10\Omega/mile$, $L = 0.00377\,H/mile$, $G = 0.9\times10^{-6}\,mho/mile$ and $C = 0.00846\,\mu F/mile$. Calculate the Reflection Coefficient and Input Impedance.
11. A Telephone cable 60km long has a resistance of $12\Omega/km$ and capacitance of $0.01\,\mu F/km$. Calculate α, v, λ of the line at $300Hz$.
12. Derive the condition for distortion less transmission line and show that $\alpha = \sqrt{RG}$, $\beta = \omega\sqrt{LC}$, $Z_0 = \sqrt{\frac{R}{G}} = \sqrt{\frac{L}{C}}$ and $v = \frac{1}{\sqrt{LC}}$.

13. Derive the line constants Z and Y of a zero dissipation less line and show that $\beta = \omega\sqrt{LC}$, $v = \frac{1}{\sqrt{LC}}$ and $\lambda = \frac{1}{f\sqrt{LC}}$.
14. Derive the expression for propagation constant of a continuously loaded line and show that $\alpha = \frac{R}{2}\sqrt{\frac{C}{L}}$, $\beta = \omega\sqrt{LC}$ and $v = \frac{1}{\sqrt{LC}}$.
15. The Primary Constants of a cable are $R = 100\Omega$, $L = 3mH$, $G = 0.34$, $C = 0.09\,\mu F/km$. Calculate Secondary Constants at 3000 Hz.
16. A transmission line has $L = 20\,mH/km$, $C = 1.2\times10^{-7}\,F/m$, $R = 10\Omega/m$ and $G = 0.9\times10^{-5}\,\Omega^{-1}/m$. Find the input impedance at a frequency of 500Hz if the line is very long.
17. Bring out the relationship between Decibel & Neper
18. Briefly explain the following (a) Standing waves (b) Reflection Loss

Unit 05:

1. What is smith chart? Mention the advantages and application of Smith chart.
2. What is stub matching? Give the names of circles on smith chart
3. Design a quarter wave transformer to match a load of 300 ohm to a source resistance 400 ohm the operating frequency is 300 MHz
4. A 70ohm lossless transmission is terminated in a load impedance of Z_L =30+j60ohm .Use the smith chart to find a) Voltage reflection coefficient b)VSWR c)Input Impedance of the line, given that the line is 2.1 lamda long and d) Input impedance of the line.
5. Derive the expression for impedance matching using quarter wave transformer
6. A lossless line has a characteristics impedance of 500 ohm. Determine the reflection coefficient if the receiving end impedance is 800+j10 ohm
7. A transmission line of length 0.3λ has a characteristic impedance of 50Ω and is terminated in a load impedance of $(100 + j150)\Omega$. Find the
   (a) Voltage Reflection Coefficient
   (b) Voltage Standing Wave Ratio
   (c) Input Impedance of the Line
8. Derive the expression for impedance matching using Quarter-Wave Transformer.
9. Design a stub to match a transmission line which is connected to a load impedance of $Z_L = (400 - j700)\Omega$. The Characteristic Impedance of the line is 100Ω. The operating frequency is $30MHz$.

10. A UHF lossless transmission line working at 1GHz is connected to an unmatched line producing a reflection coefficient of $0.5(0.866 + j0.5)$. Calculate the length and position of the stub used to match the line.
11. Find the input impedance of 90Ω lossless transmission line of length 0.2λ when the load is a short.
12. A 400Ω transmission line is connected to a load impedance of $(450 - j600)\Omega$ at 10MHz. Find the position and length of a short circuited stub required to match the line using Smith Chart.
13. Design a Quarter-Wave Transformer to match a load of 200 ohm to a source resistance of 500 ohm and the operating frequency is 200 MHz.
14. Use the smith chart to find the following quantities for the transmission line circuit with characteristic impedance of $Z_0 = 50\Omega$, Load impedance of $Z_L = (60 + j50)\Omega$ and the length of the transmission line is $l = 0.4\lambda$.
    (i) VSWR
    (ii) Reflection Coefficient at Load, (Γ_L)
    (iii) Load Admittance, Y_L
    (iv) Input Impedance, Z_{in}
    (v) Distance from the Load to the first Voltage Minimum $(dV_{\min})$
15. Design a stub to match a transmission line which is connected to a load impedance of $Z_L = (400 - j600)\Omega$. The Characteristic Impedance of the line is 300Ω. The operating frequency is $20MHz$.