Benha University
Faculty of Engineering at Shoubra
Electrical Engineering Department

Microwave fundamentals
3rd Year Communications
(2018-2019)

Sheet 1

1. Starting from the transmission line model, derive an equation for the attenuation constant and phase constant of transmission line in terms of R, L, C, G.

2. Use the telegrapher equation, and general solution of wave equation to derive an equation for the characteristic impedance of transmission line.

3. The current on a transmission line is given as $i(t) = 1.2\cos(1.51\times10^{10}t - 80.3z)$ A. Determine (a) the frequency, (b) the wavelength, (c) the phase velocity, and (d) The phasor representation of this current.

4. A transmission line has the following per unit length parameters: L=0.2μH/m, C=300pF/m, R=5Ω/m and G=0.01S/m. Calculate the propagation constant and the characteristic impedance of this line at 500MHz. Recalculate these quantities in the absence of loss (R=G=0).

5. The parameters of a certain transmission line operating at 6×10^8 rad/s are L=0.4μH/m, C= 40 pF/m, G=80 mm S/m, and R=20Ω/m. a) Find γ, α, β, λ, and Z_0.

6. The characteristic impedance of a certain lossless transmission line is 72 Ω. If L = 0.5μH / m, Find C, v_{ph} and β If f = 80MHz.

7. A lossless transmission line having Z0 =120Ω is operating at $\omega=5\times10^8$ rad/s. If the velocity on the line is 2.4×10^8 m/s, find L and C.

8. Two characteristics of a certain lossless transmission line are Z0=50Ω and γ= 0+ j 0.2π m^{-1} at f=60 MHz. Find L and C for the line.

9. The propagation constant of a lossy transmission line is 1+j2 m^{-1}, and its characteristic impedance is 20+j0 Ω at ω=1 M rad/s. Find L, C, R, and G for the line.

10. The incident voltage wave on a certain lossless transmission line for whichZ_0=50Ω and $v_{ph}=2\times10^8$ m/s is $V^+(z, t)=200\cos(\omega t-\pi z)$V.
    a) Find ω. b) Find $I^+(z, t)$.

Good Luck

Dr. Gehan Sami