MICROWAVE ENGINEERING
Final Exam

July 7, 2020

Open Books/Notes
Duration: 90 minutes.
Notes:

(1) Weights:1a ,1b,1c, 2a, 2b: 10/100, 3:20/100, 4: 30/100.
(2) When the Smith chart is used for performing certain calculations all operations made on the chart should be clearly explained.

1. Find the following quantities for the transmission line circuit shown in Figure-1.
(a) The SWR (Standing Wave Ratio) on the line and the input impedance (Z_{in}).
(b) The power delivered to the load (P_{load}).
(c) Find the distances from the load to the first voltage maximum and minimum.

2. A voltage source $Vg = 12V$ is applied through an internal resistance $Rg=Z_0/3$ to a lossless transmission line with length of L at $t = 0$. The transmission line is also terminated with an open circuit. The required time for a traveling wave to reach to the end of line from the source is defined as $T=L/v_p$ (v_p:phase velocity).

a) Draw the voltage and current variations in the middle of the line (z = L/2) which are v=v(z=L/2,t) and i =i(z=L/2,t) for $0 \le t \le 5T$.
b) Draw the voltage and current variations on the line at T=1.5T as v=v(z,t=1.5T) and i =i(z,t=1.5T) considering $0 \le z \le L$.

3. Determine the generalized Scattering (S) matrix for the network shown in Figure-3. Which properties of this network can be inferred from its S matrix?

4. A transmission line with the characteristic impedance of Z_0=50 Ω is terminated with a load impedance of Z_L=40-j30 Ω. Calculate all solutions for the distance (D) and the length (L) by using the Smith Chart when a parallel single-stub matching network terminated with a short circuit is used as shown in Figure-4.

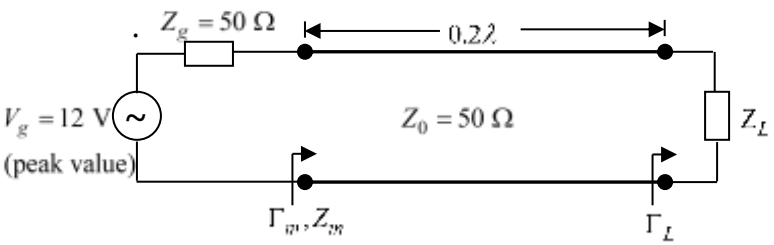

Figure-1

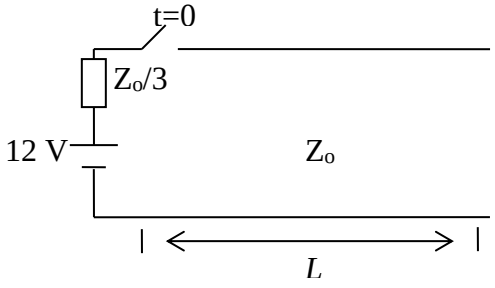

Figure -2

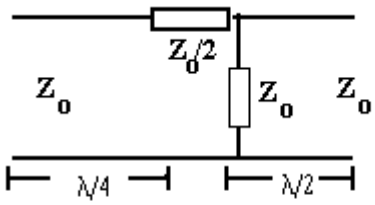

Figure -3.

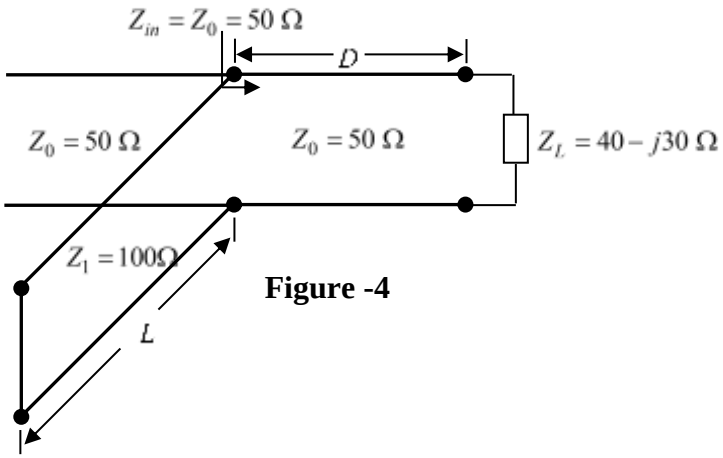

Figure -4