Sharif University of Technology

Communication Circuits

Problem set 3

Due Date: 16 Aban

You may submit your solutions in class or in the box.

1. Design L-section matching circuit without writing kvl-kcl and don't use Smith chart.

a. L section: R=60ohm, C=10pF, freq=10GHz (series).

b. L section: R=60ohm, C=10pF, freq=10GHz (parallel).

2. A 50-Ω transmission line is terminated by an unknown load. The total voltage at various ponits of the line is measured and found to be as displayed in figure1. Determine A. the magnitude of reflection coefficient. B. the signal wavelength in meters.

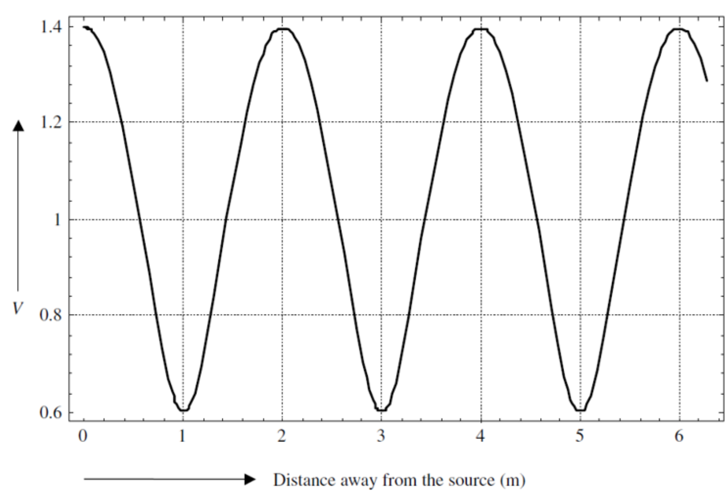

Figure 1

3. Complete or verify the following six-iterstage designs of f=4GHz. Show the six solutions on smith chart.

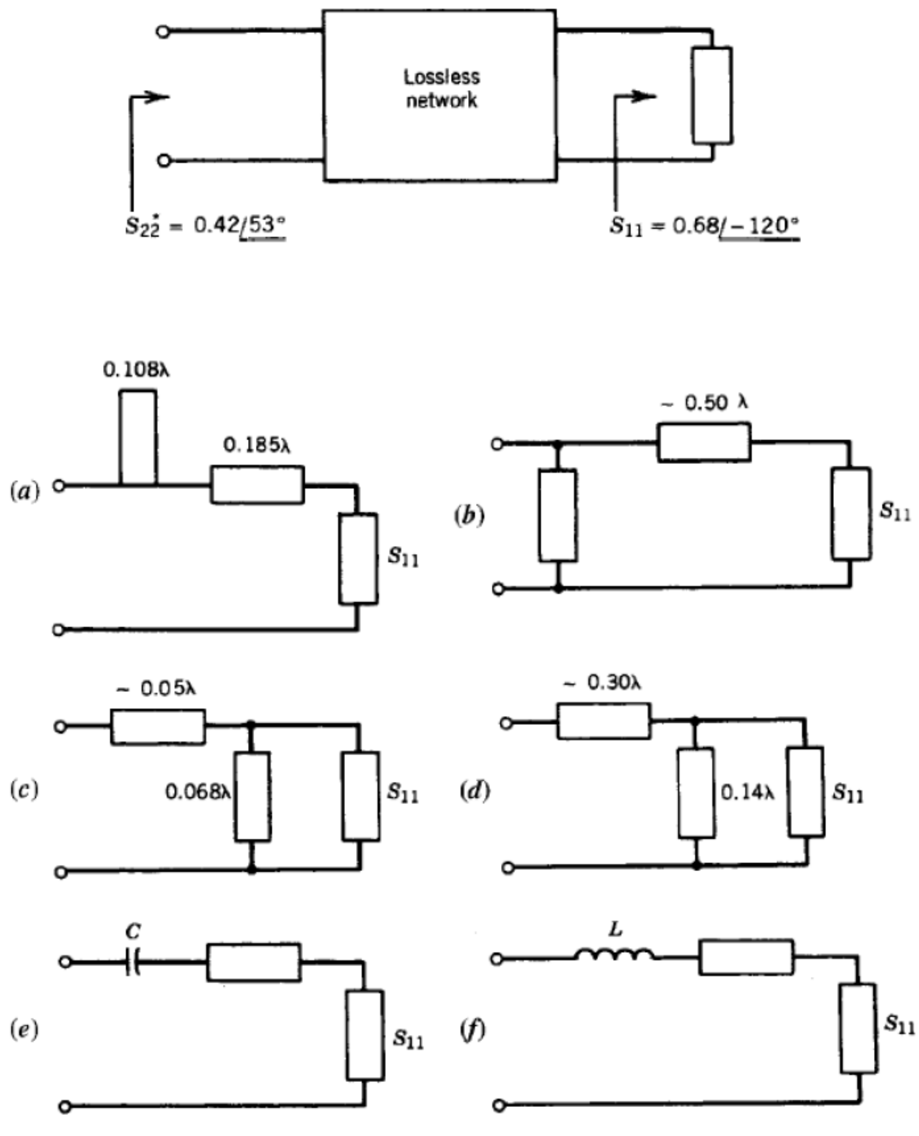

Figure 2

4. The transistor S-parammeters are usually given by two-port parameters measured with the source or emittre grounded. The two-port S-parameters for the common emitter or source are obtained by grounding

port three of the transistor three-port. Obtain this relation!
Hint:

$$\begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} = \begin{bmatrix} S'_{11} & S'_{12} & S'_{13} \\ S'_{21} & S'_{22} & S'_{23} \\ S'_{31} & S'_{32} & S'_{33} \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \\ -b_3 \end{bmatrix}$$

For example, Arrive that S21:

$$S_{21} = S'_{21} - \frac{S'_{23} S'_{31}}{1 + S'_{33}}$$

We can reverse the two above process to find the three-port S-parameters are given with one terminal grounded, find the three-port S-parameters:
Hint: Since reflected wave relate to incident wave by scatttering matrix, consider the case where $a_2=a_3=0$, as shown in fig3. Then $b_1=S_{11}a_1$,$b_2=S_{21}a_1$, and $b_3=S_{31}a_1$, and at P we can write $I^+_1=I^-_1+ I^-_2+ I^-_3$. Therefore, it follow that: $S_{11}+S_{21}+S_{31}=1$.

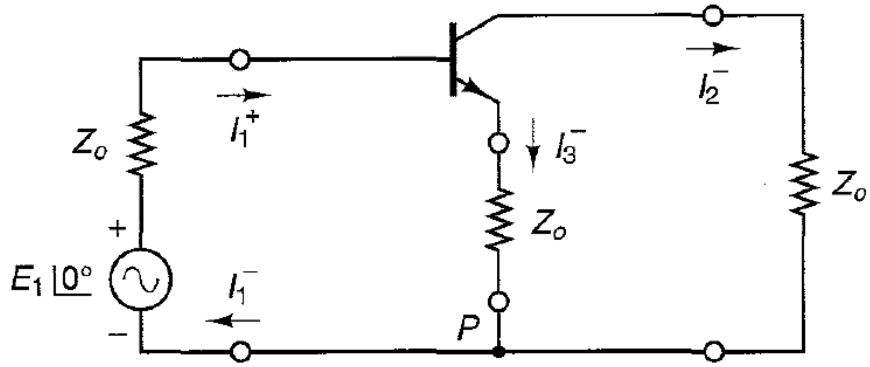

Figure 3

5. In design matching circuit with the transmission line (TL), you have two right choose for TL length. Explain your argument for choosing which one.