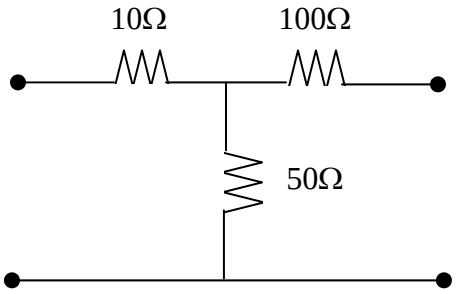
Semester Test for ELEC2230 – February/March 2004

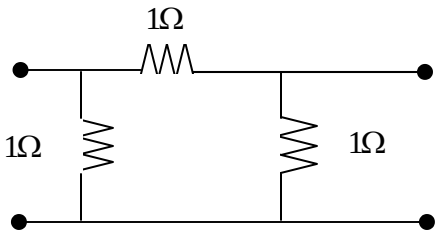
ANSWERS

1. Write down the Z matrix of this circuit. [1 mark]



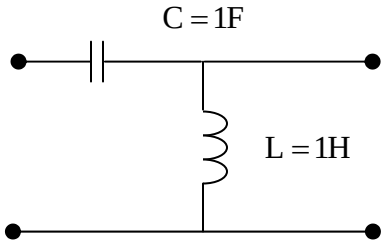
$$\begin{bmatrix} 60 & 50 \\ 50 & 150 \end{bmatrix} \Omega$$

2. Write down the Y matrix of this circuit. [1 mark]



$$\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} \mathrm{S}$$

3. Write down the ABCD matrix of this circuit at a frequency of 1 rad / second. [2 marks]



$$\begin{bmatrix} 1 & -j \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -j & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & -j \\ -j & 0 \end{bmatrix}$$

4. Write down the Insertion Loss of a circuit with the following transfer matrix -

[2 marks]

$$[T]=\begin{bmatrix} 2 & j3 \\ -j & 2 \end{bmatrix}$$

$10\log[1+4]=10\log 5=7$ dB

5. A circuit has the following S parameters -

[4 marks]

$$[S]=\begin{bmatrix} \frac{1}{\sqrt{2}}+\frac{j}{\sqrt{2}} & j0.1 \\ j3.333 & 0 \end{bmatrix}$$

Write down the –

Input Return Loss in decibels — 0

Output Return Loss in decibels — ∞

Forward Gain in decibels — 10.457 dB

Reverse Gain in decibels — -20 dB

6. On a transmission line, what fraction of the incident power is absorbed by the load when the return loss is 0dB? What is it for infinite return loss?

0

100%

[2 marks]

7. A return loss of 20 dB is measured at one end of a 50 Ω transmission line. Assuming real impedance values only, what is the load resistance? Is there another value that will result in the same return loss?

61.1 Ω

40.9 Ω
(½ mark for "Yes")

[2 marks]

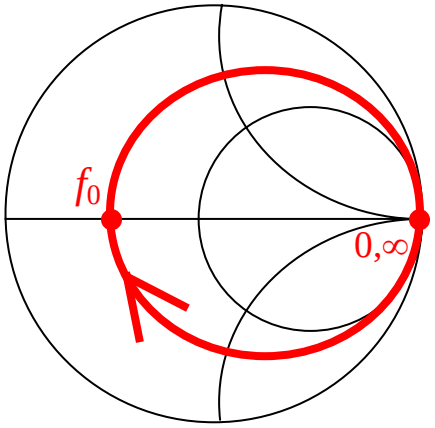
8. What is the impedance of the quarter-wave matching section required to match a 50 Ω line to a 25 Ω load impedance? What length is required with an air-dielectric transmission line at a frequency of 3 GHz?

35.5 Ω

2.5 cm

[2 marks]

9. On the Smith Chart outline, sketch the response over the frequency range from DC to infinity for a series RLC circuit. Mark the beginning (0) and end (∞) frequencies, an arrow showing the direction in which frequency is increasing and the location of the resonant frequency (f_0)



[4 marks]