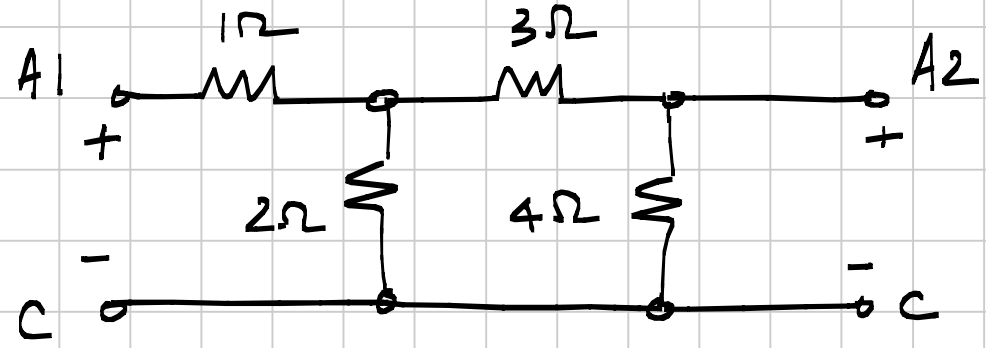
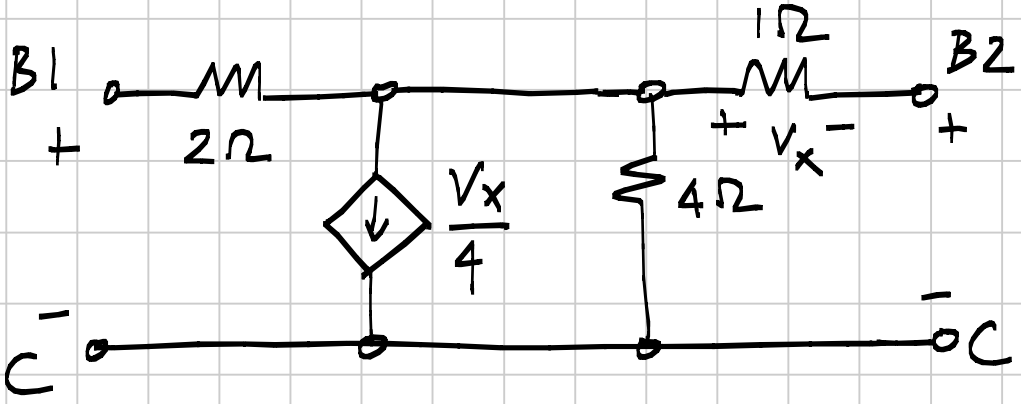
EC2010: Analog Circuits

Tutorial 1

1) Find the y-parameters of the following 2 port network



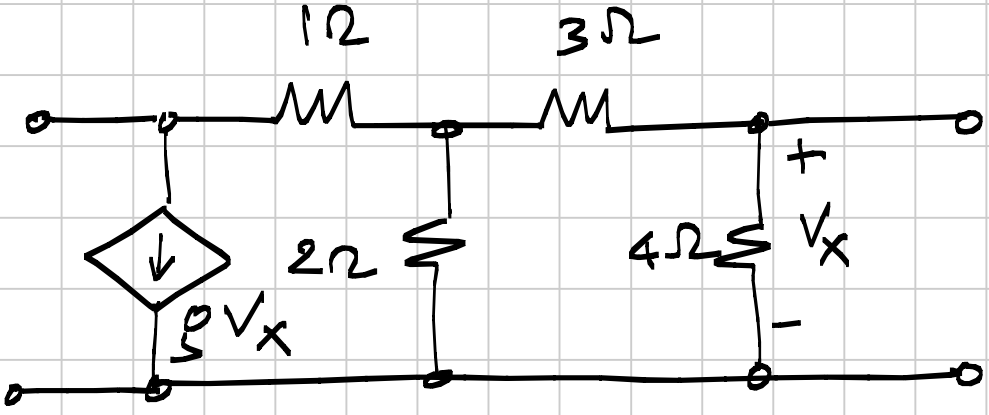
2)



Determine the y-parameters of the network above.

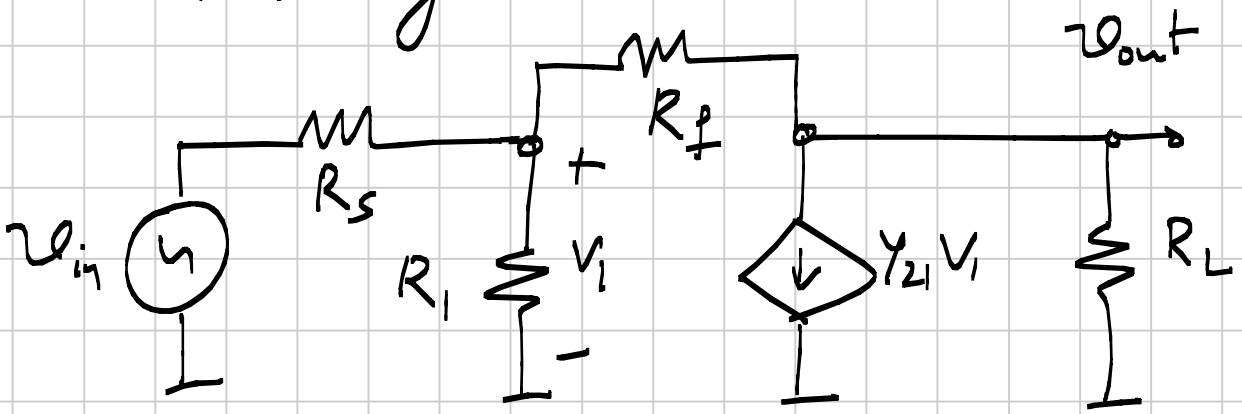
3) The terminals A1 & B1 in the figures above are shorted. So are A2 & B2; and the terminals marked C. Determine the y-parameters of the resulting 2 port.

4)



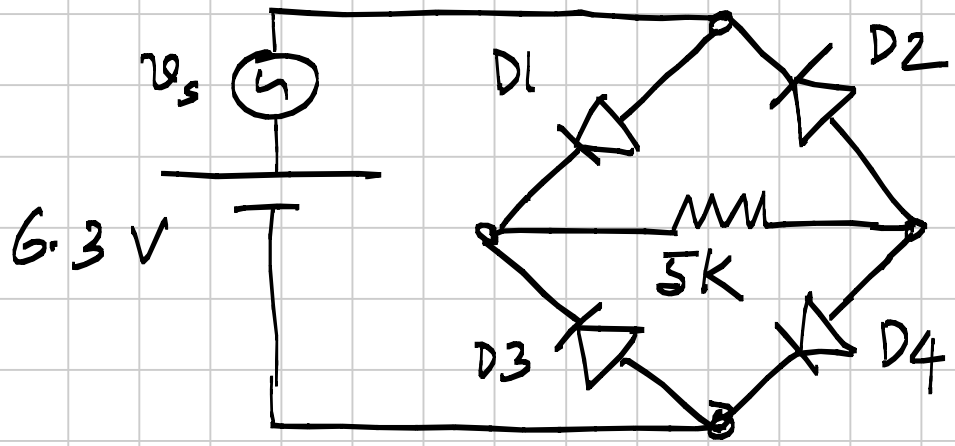
What do you understand by a unilateral two port? What constraint(s) does it impose on the y-matrix? The network above needs to be made unilateral. Determine "g" for this to happen.

5) Determine the voltage gain of the following network.



Evaluate the limit of this gain as $Y_{21} \longrightarrow \infty$.

6)



v_s is a small signal. Determine

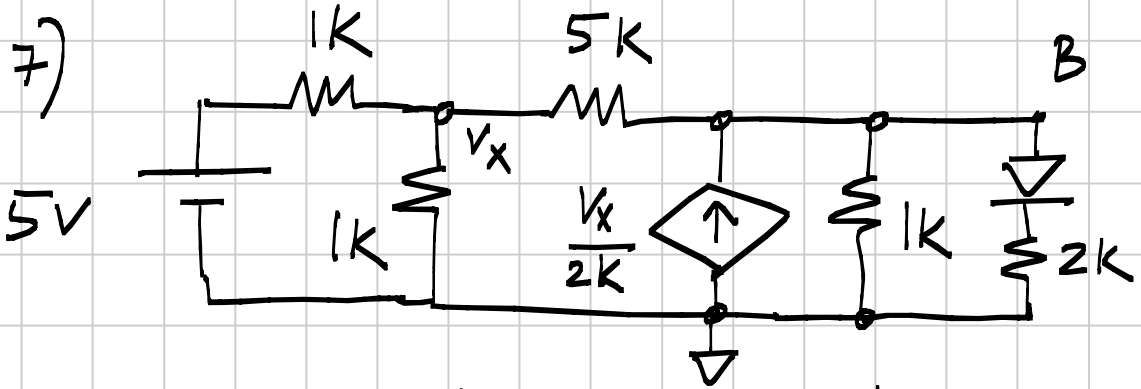
(a) the operating points of the diodes

(b) the DC current through the 5K resistor

(c) the incremental voltage across the 5K resistor.

Assume that $V_\gamma = 0.65V$

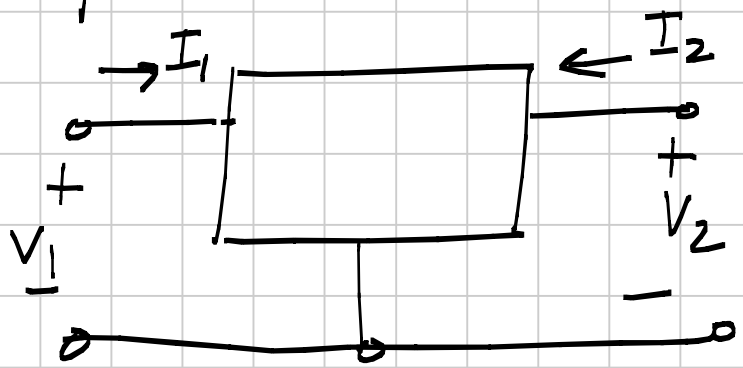
7)



Determine the quiescent current through the diode. If a small

signal source v_s is inserted in series with the 5V source, determine the TOTAL voltage at B. V_γ can be assumed to be 0.6 V.

8) A passive three terminal two port is shown below.



It is characterized by the equations

$$I_1 = \alpha V_1$$

$$I_2 = \beta V_1^2 + \gamma V_2$$

Where α, β, γ are positive constants with appropriate dimensions.

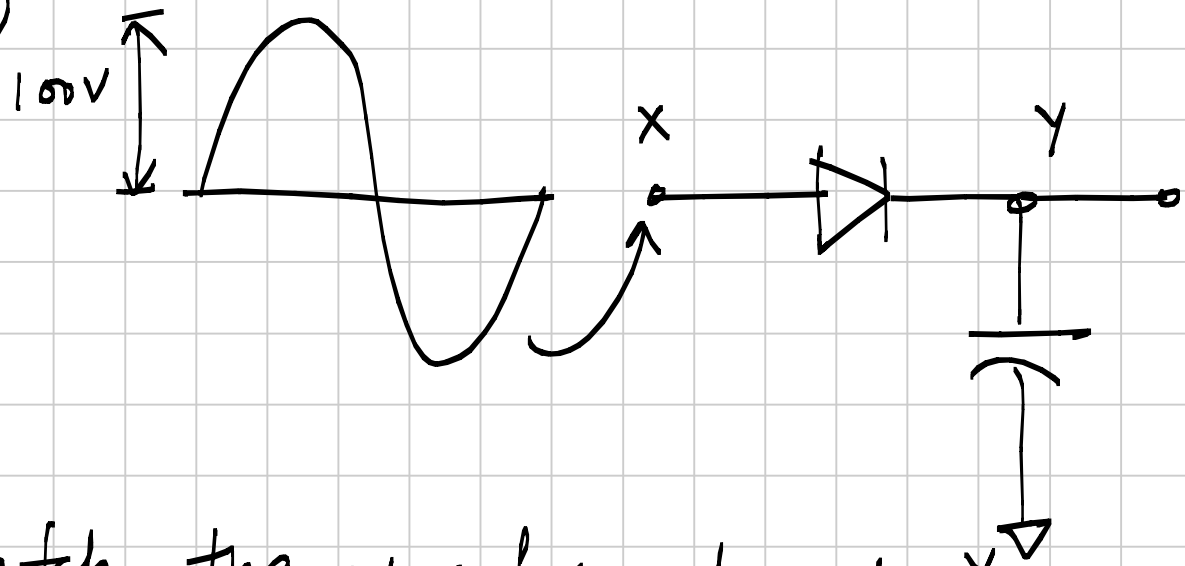
(a) Sketch the input & output

Characteristics of the device.

(b) Determine the incremental y-matrix when the two port is biased at an operating point (V_1, V_2).

(c) Is this a passive two port?

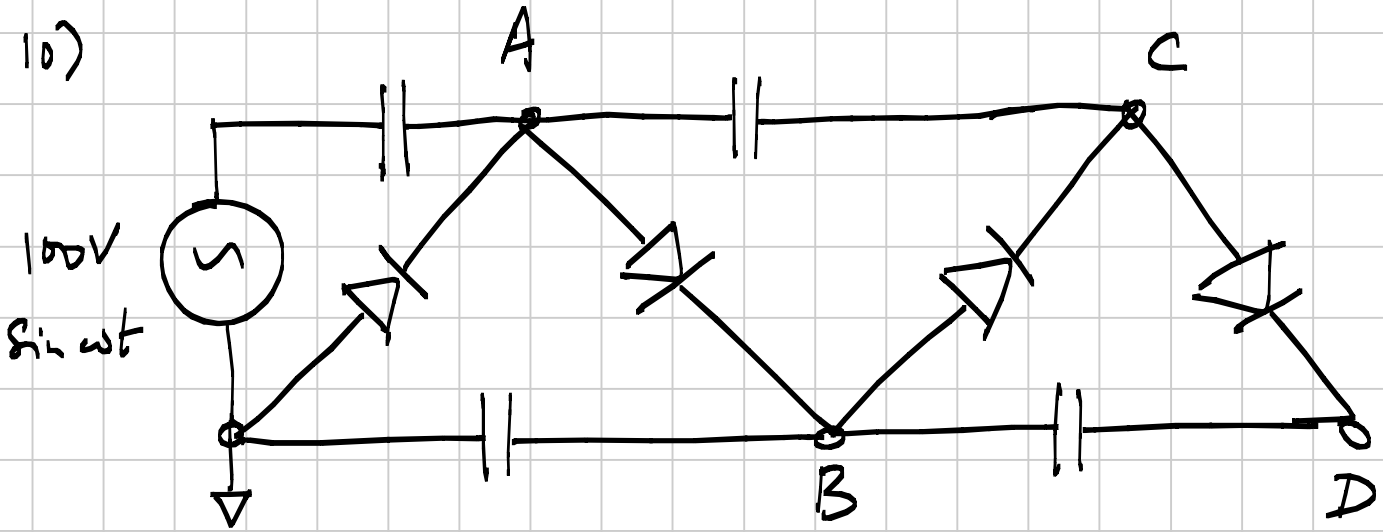
9)



Sketch the waveform at node Y.

The maximum reverse bias voltage that a diode can withstand is called the breakdown voltage. How large should this voltage be, if the diode is not to breakdown?

10)



$\omega = 2\pi\ 50\ Hz$. The diodes are ideal.

(a) sketch the voltage waveforms at A, B, C, D.

(b) In steady state, what is the potential at D?

(A similar arrangement is used in the Mosquito Zapper Bat).