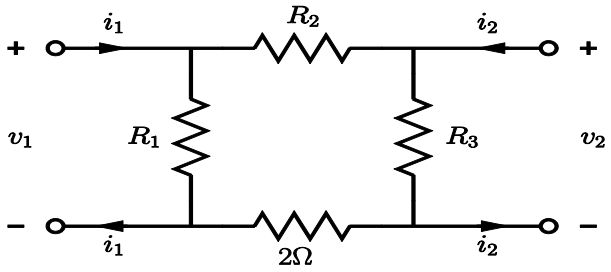
METU/EEED
EE 201

HOMEWORK IV

Question 1 For the following two port, the hybrid parameters are given as:

$$\begin{bmatrix} v_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} 4 & 1/2 \\ \alpha & 1/8 \end{bmatrix} \begin{bmatrix} i_1 \\ v_2 \end{bmatrix}.$$

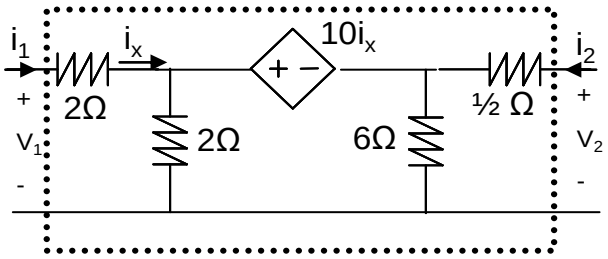


a) Find α.

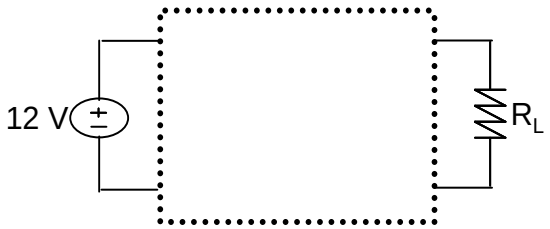
b) Find R_1, R_2, and R_3.

Question 2

a) Obtain the resistance parameters for the following two-port circuit.



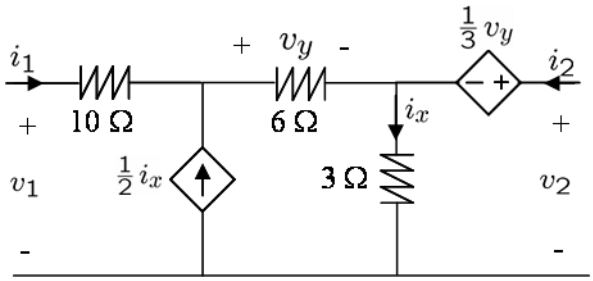
b) The two port shown in Part (a) is used in the following configuration. Determine R_L so that the power absorbed by R_L has the maximum value. Also compute this power.



Answer *(b) $R_L = 3.5\ \Omega$, $P_L = 72/7$ W.*

Question 3

a) Obtain the hybrid parameters for the following two-port circuit.



$$\begin{bmatrix} v_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} i_1 \\ v_2 \end{bmatrix}$$

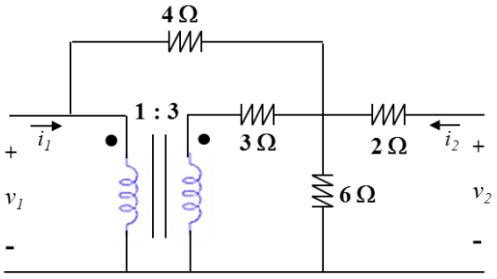
b) Using the hybrid representation, find the power input to the two-port circuit given $v_1 = 8$ V and $i_2 = -4$ A.

c) Let $v_1 = 8$ V and $i_2 = -4$ A. Solve the circuit, determine the powers supplied/absorbed by the elements, and verify the result of Part (b).

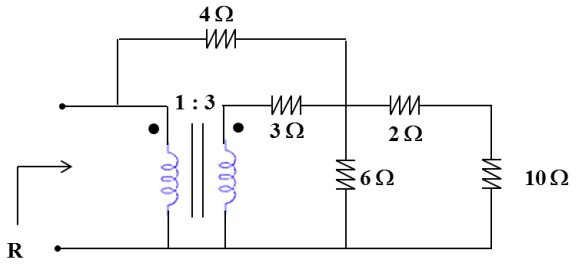
Answer (b) 64 W.

Question 4

a) Obtain the conductance (short circuit) and transmission parameters for the following two-port circuit.



b) The secondary port is terminated with a 10 Ω resistor as shown below. Find the input resistance R by driving the port terminals with a test source.

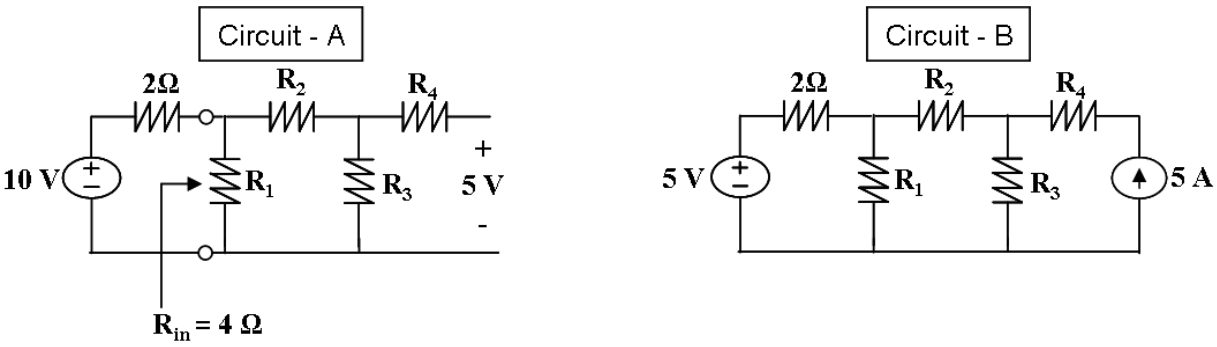


c) Find R using the short circuit representation of the two-port circuit.

d) Find R using the transmission representation of the two-port circuit.

Answer (b) R = 8/11 Ω.

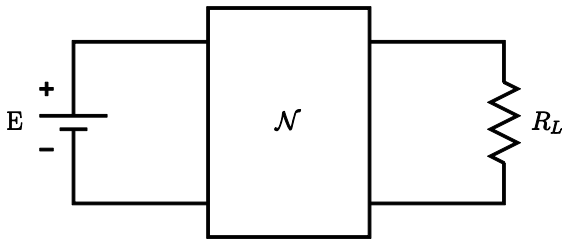
Question 5 Consider the circuits A and B given below.



Find the power supplied/absorbed by the 5 V source in Circuit - B.

Answer *25/3 W, absorbed.*

Question 6 Consider the following circuit where the two-port circuit $\mathcal{N}$ contains only passive LTI resistors and ideal transformers. R_L is a passive load resistor. The power supplied by the source is denoted by P_s, and the power delivered to the load is denoted by P_L.



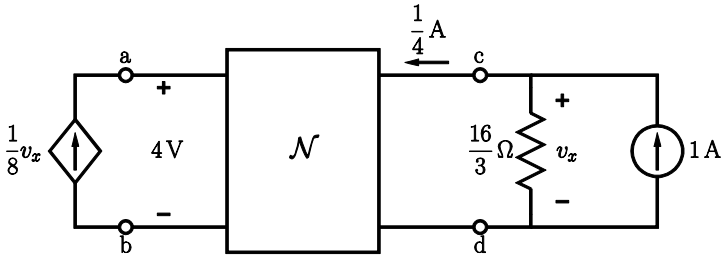
The measurement results of two experiments are given in the table below.

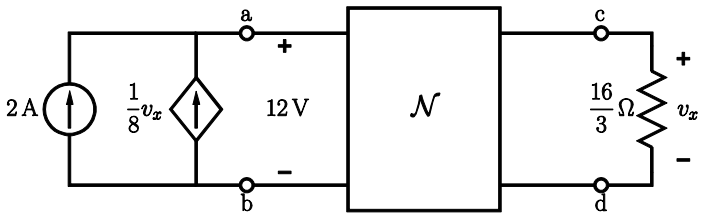
	R_L	P_s	P_L
Exp. #1	3 Ω	16 W	P_o
Exp. #2	12 Ω	14 W	P_o

a) Find P_o. (*Hint: Tellegen's theorem.*)
b) What is the value of R_L that maximizes P_L?
c) Suppose that a third experiment with the R_L value found in Part (b) is performed. What will P_L and P_s be in this case?
d) Obtain the short circuit parameters for $\mathcal{N}$ in terms of E.
Determine a set of suitable E values. Assign a value to E and design $\mathcal{N}$.

Answer *(a) $P_o = 4/3$ W, (b) $R_L = 6\ \Omega$, (c) $P_L = 1.5$ W, $P_s = 15$ W.*

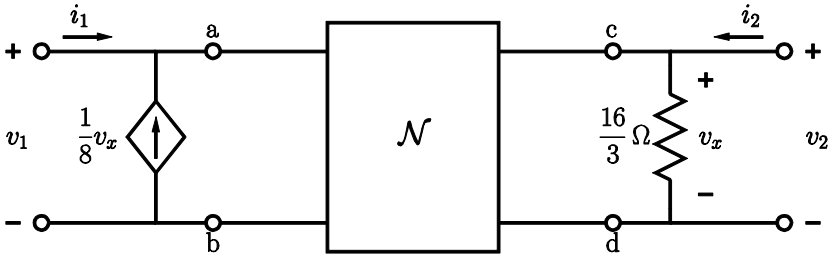
Question 7 Consider the circuits below where the two-port $\mathcal{N}$ contains only LTI resistors and ideal transformers.





a) Find the value of v_x in the circuit that is driven by the 2A current source.

b) Obtain the resistance parameters for the below two-port circuit.



$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} \\ r_{21} & r_{22} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$$

c) Given $i_1 = -2$ A and $i_2 = 4$ A, find the power input to the two-port $\mathcal{N}$.

d) Obtain the resistance parameters for the two-port $\mathcal{N}$.

Answer *(a) $v_x = 4$ V, (c) 19 W.*