

# EECE 1010: Electrical and Magnetic Circuits.

Note Title

1/28/2013

Problem set #2 (Due on 11 Feb. 2013)

HKD: Hayt, Kemmerly, and Durbin

Engineering circuit analysis, 7<sup>th</sup> Edition  
Tata McGraw Hill 2010, 2006

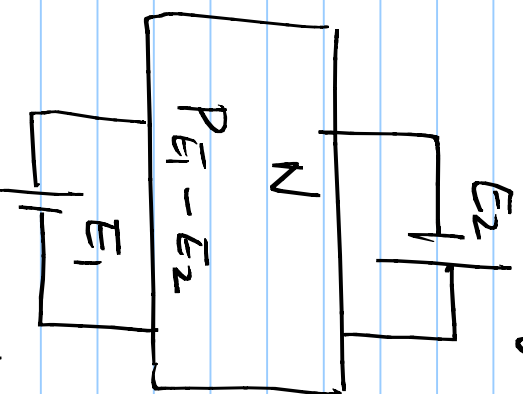
# Electric & Magnetic Circuits

Note Title

03-02-2012

## Problem Set 2

1) Let  $P_{E_1+E_2}$  and  $P_{E_1-E_2}$  be the powers dissipated in a network  $N$  consisting of linear, time-invariant resistances excited by two voltage sources  $E_1$  &  $E_2$  as shown in Fig 1(a) & (b) respectively.



Determine

$$(P_{E_1} + P_{E_2})$$

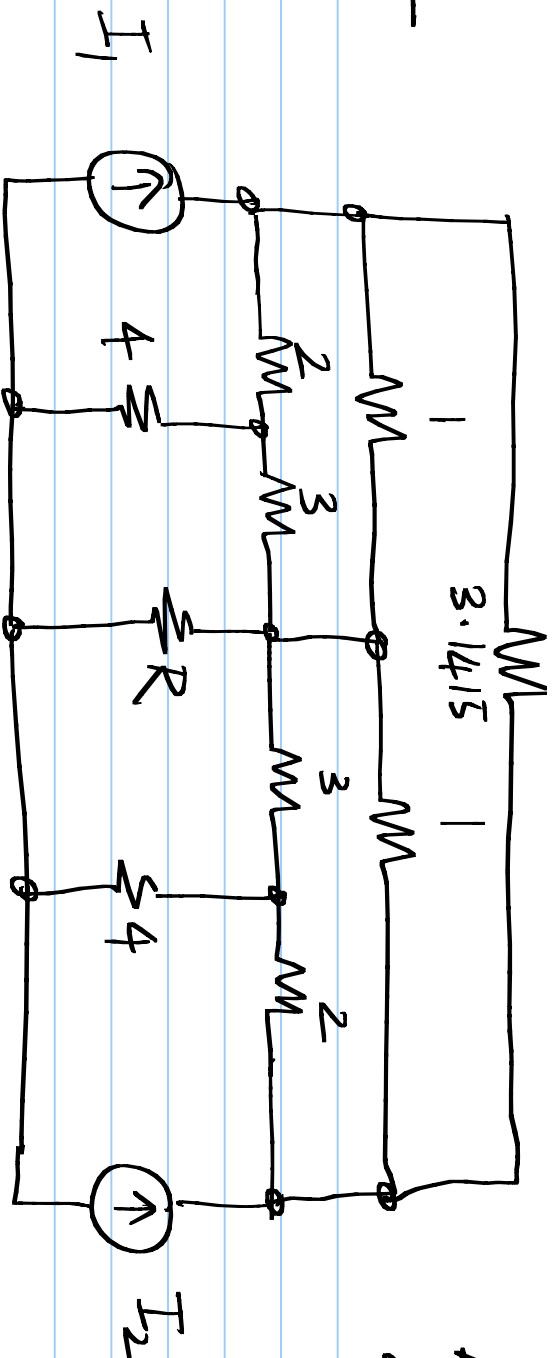
in terms of

$$P_{E_1+E_2} \text{ \& \ } P_{E_1-E_2},$$

where  $P_{E_1}$  &  $P_{E_2}$  are powers dissipated in  $N$  while acting alone.

## Problem 2

All resistors  
are in ohms.



(a) for  $I_1 = I_2 = 1A$ , determine  $R$  so that it dissipates the maximum power. What is the value of the power?

(b) Repeat the above exercise for  $I_1 = -1A$  &  $I_2 = 1A$

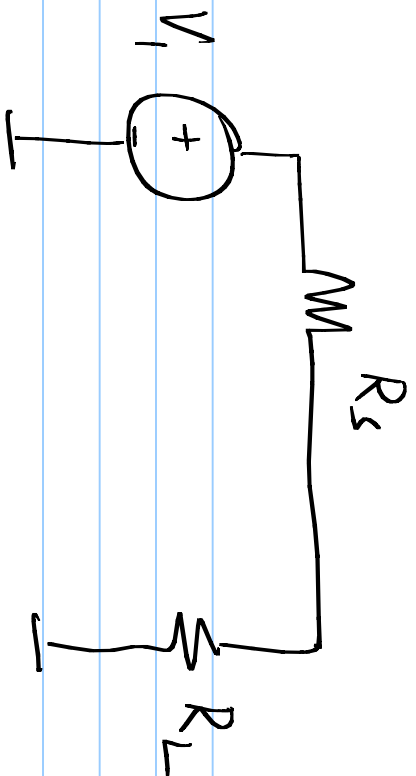
(c) Repeat (a) for  $I_1 = 1A$  &  $I_2 = 4A$

Problem 3 :- A network  $N$  composed of resistors only has two pairs of terminals brought out. When a voltage source of  $20V$  is connected across the first pair of terminals, resistances of  $2\Omega$  &  $6\Omega$  connected across the other pair of terminals draw  $4A$  &  $2A$  respectively.

(a) A current source and a variable resistance are now connected in parallel across the second pair of terminals and the resistance is varied till the power consumed by it is maximum, this maximum being  $18W$ . What is the magnitude of current in the current source?

(b) The voltage source is replaced by an ammeter and a voltage source of  $30V$  is connected at the second pair of terminals. What is the current read by the ammeter?

## Problem 4



(denoted by  $P_L$ )

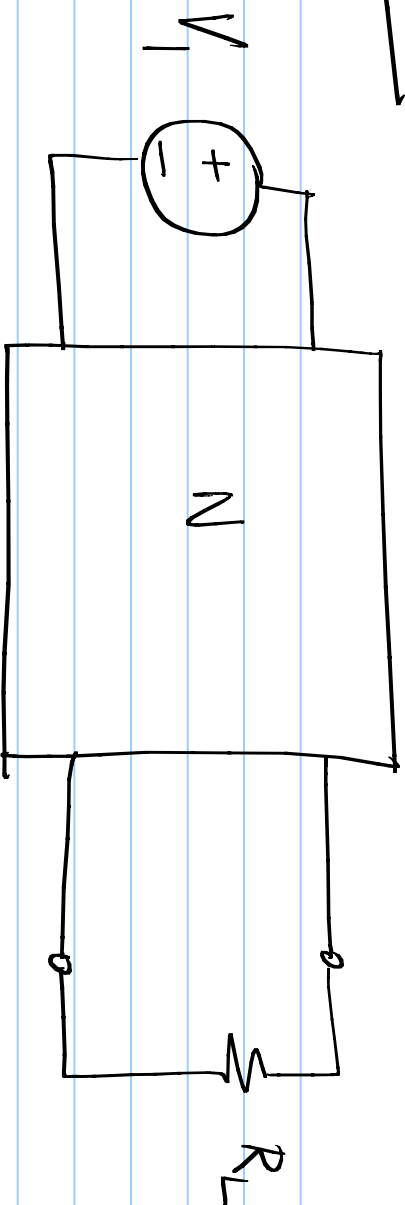
Show that the power dissipated in  $R_L$  can be expressed as

$$P_L = P_{\max} (1 - |\Gamma_L|^2)$$

where  $\Gamma_L = \frac{R_L - R_S}{R_L + R_S}$ , and  $P_{\max}$  is independent of  $R_L$ .

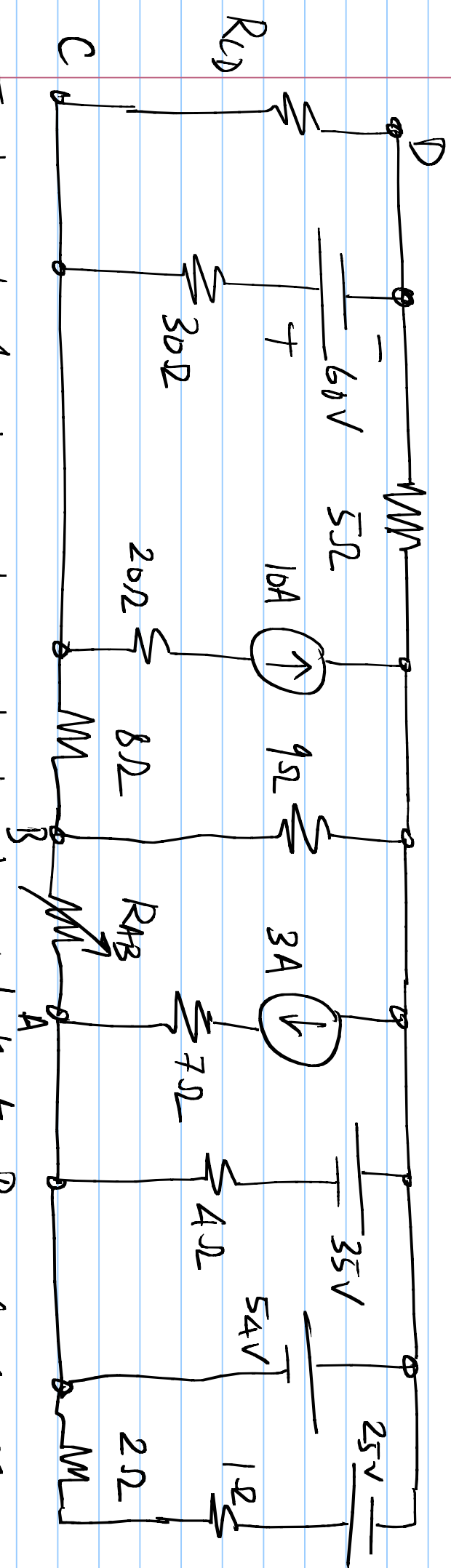
Determine  $P_{\max}$ .  $\Gamma_L$  is called the reflection coefficient of the load  $R_L$ . For what  $\Gamma_L$  is maximum power dissipated in  $R_L$ ?

### Problem 5:



$N$  is a network with resistors only. It is observed that the power dissipated in  $R_L$  is equal to  $8\text{ W}$  when  $R_L$  is either  $25\Omega$  or  $100\Omega$ . Determine the power dissipated in  $R_L$  when  $R_L = 75\Omega$ .

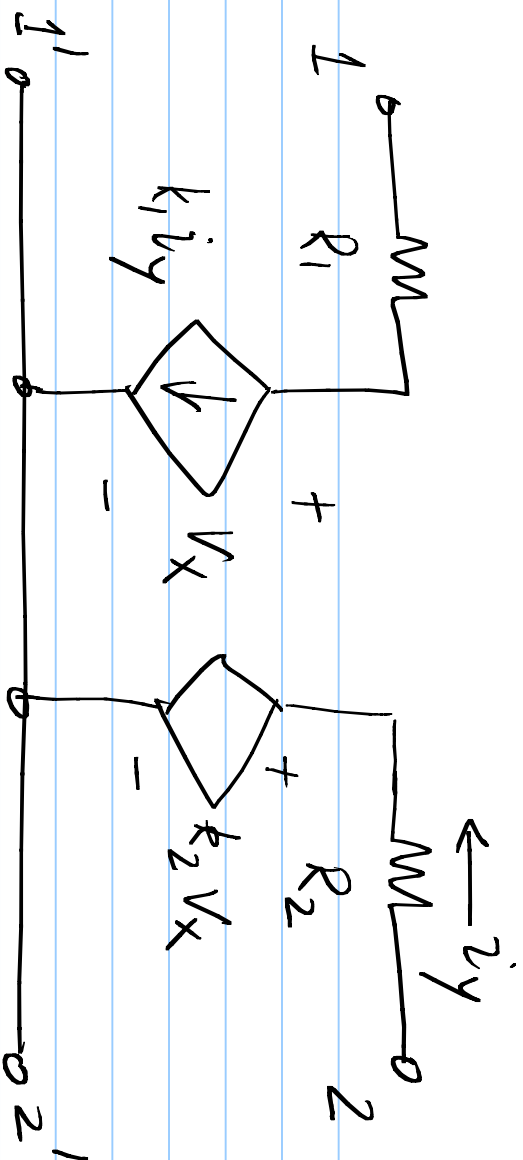
Problem 6



In the network shown above, it is observed that  $R_{AB}$  consumes maximum power when it is equal to  $R_{CD}$ .

Calculate  $R_{CD}$  & the maximum power input to  $R_{AB}$ .

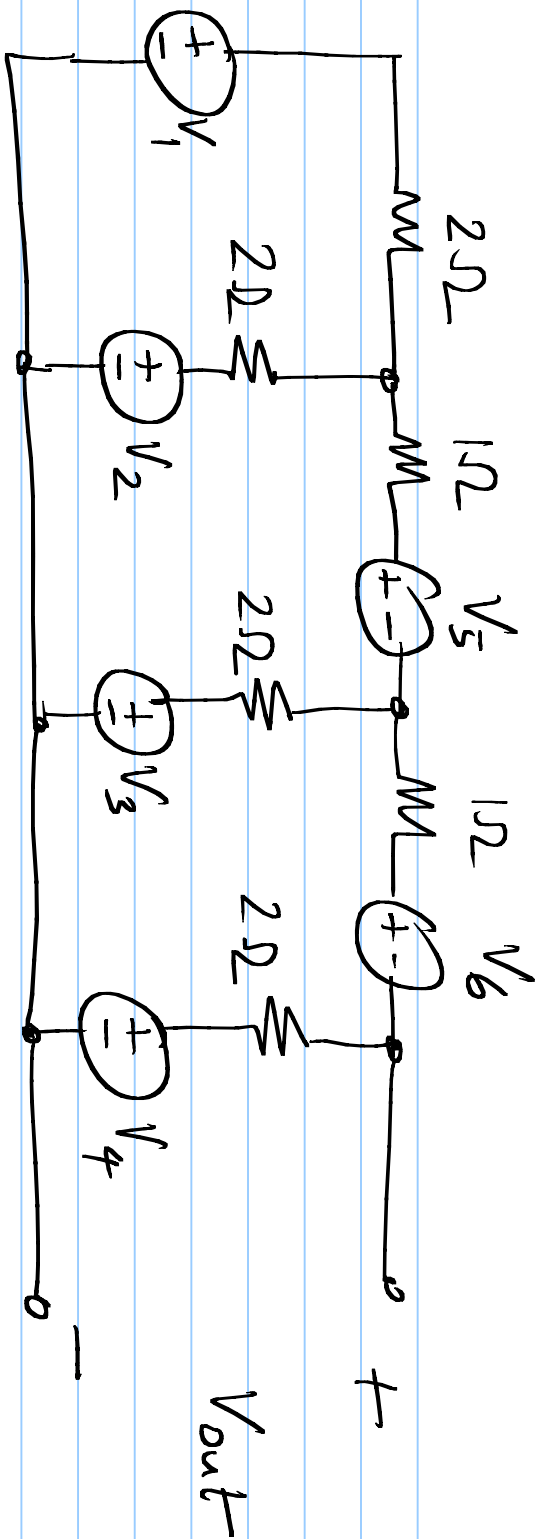
## Problem 7



The two port shown above should be reciprocal. Determine the condition that should exist among the constants  $k_1$ ,  $k_2$  and  $R_1$ ,  $R_2$ .



### Problem 8

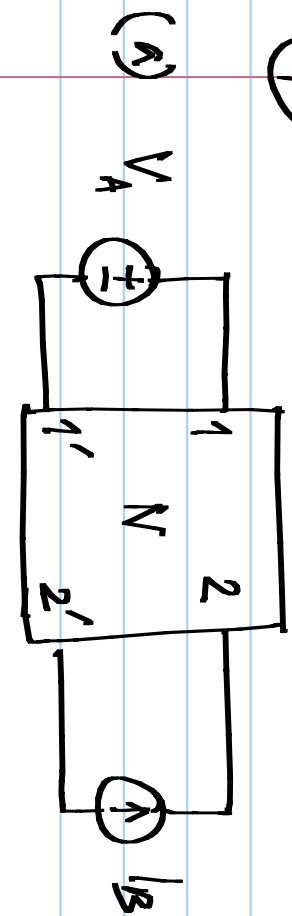


For the circuit above, determine

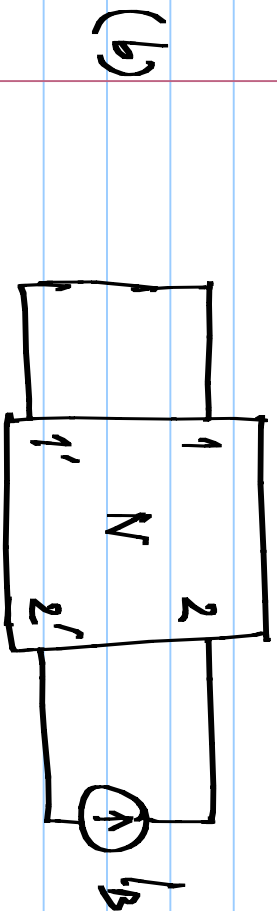
$$\frac{V_{out}}{V_1}, \frac{V_{out}}{V_2}, \dots, \frac{V_{out}}{V_6}$$

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$N$  consists only of resistors.



Relate the power dissipated in the network  $N$  in

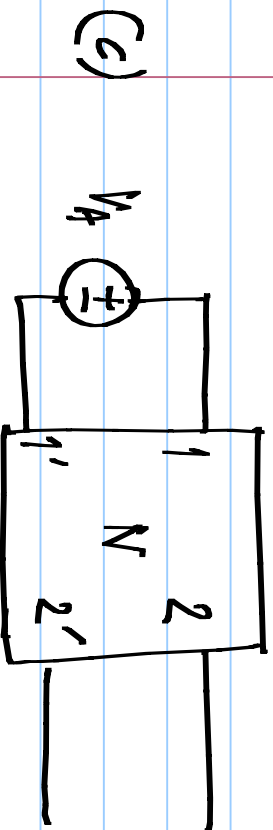


(a) to that in (b) and

(c).

Is this relationship true

in general?



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Additional practice problems on circuit theorys

HKD, chapter 6

problems 20-69

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