



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

KUET

SESSIONAL REPORT

Department Of Computer Science and Engineering
Experiment No. 04

Course No. EEE 1108
Name of the Experiment Verification of Reciprocity Theorem

Remarks

Not done

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OBJECTIVES:

01. Gather knowledge about reciprocity theorem and be able to apply and test the theorem.
02. To know about circuit connections and maintaining currents for any combination of some elements in circuit.
03. To measure the current flowing through a branch varying with emf's position and thus verify the reciprocity theorem.

INTRODUCTION:

The reciprocity theorem states as follows:

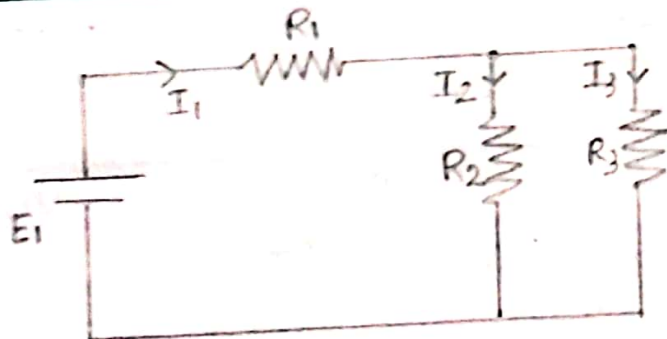
"The current, I , in any branch of a network, due to a single voltage source (or battery), E , anywhere else in the network will equal the current through the branch in which the source was originally located if the source is placed in the branch in which the current I was originally measured."

In other words, the location of voltage source and resistors may interchange in a circuit, but the value of current will remain unchanged. It is to be noted here that, this theorem is applicable for single source networks.

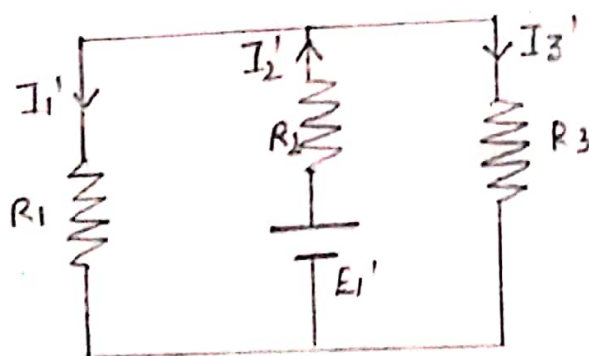
APPARATUS REQUIRED :

L No.	Name of the Apparatus	Rating	Quantity
1	DC Power Supply	(0-30)V, 5A	1
2	DC Ammeter	(0-5)A	1
3	Tumbler switch	250V, 6A	3
4	Rheostat	21 Ω , 98 Ω , 25 Ω , 5A	3
5	Connecting Wires	—	as required

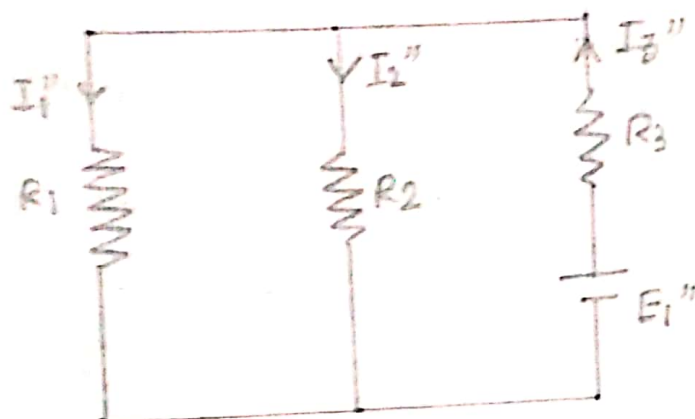
EXPERIMENTAL SETUP:



When source is in R_1 branch



When source is in R_2 branch



when source is in R_3 branch.

EXPERIMENTAL DATA:

E	R_1	R_2	R_3
$E_1 = 10V$	$I_1 = 0.23A$	$I_2 = 0.04A$	$I_3 = 0.19A$
$E_1 = 15V$	$I_1 = 0.36A$	$I_2 = 0.07A$	$I_3 = 0.28A$
$E_1' = 10V$	$I_1' = 0.04A$	$I_2' = 0.09A$	$I_3' = 0.04A$
$E_1' = 15V$	$I_1' = 0.07A$	$I_2' = 0.13A$	$I_3' = 0.06A$
$E_1'' = 10V$	$I_1'' = 0.19A$	$I_2'' = 0.04A$	$I_3'' = 0.23A$
$E_1'' = 15V$	$I_1'' = 0.28A$	$I_2'' = 0.06A$	$I_3'' = 0.34A$

RESULT:

(i) According to the theorem, $I_1' = I_2$

For $\underline{\underline{10V}}$, $I_1' = 0.04A$

$$I_2 = 0.04A$$

$$\therefore I_1' = I_2$$

For $15V$, $I_1' = 0.07A$

$$I_2 = 0.07A$$

$$\therefore I_1' = I_2$$

(ii) Again, according to the theorem, $I_2'' = I_3'$

For $10V$, $I_2'' = 0.04A$

$$I_3' = 0.04A$$

$$\therefore I_2'' = I_3'$$

For $15V$, $I_2'' = 0.06A$

$$I_3' = 0.06A$$

$$\therefore I_2'' = I_3'$$

(iii) And, according to the theorem, $I_1'' = I_3$

For $10V$, $I_1'' = 0.19A$

$$I_3 = 0.19A$$

$$\therefore I_1'' = I_3$$

For $15V$, $I_1'' = 0.28A$

$$I_3 = 0.28A$$

$$\therefore I_1'' = I_3$$

DISCUSSION:

According to reciprocity theorem, in circuits with single voltage source, the value of current remains unchanged while interchanging the branches that hold battery and resistors. Here, in our experiment, we used two voltage sources of 10V and 15V. We used 3 resistors and got total 18 values of current in different positions of ~~resistors~~ battery in different resistive branches. We found, $I_1'' = I_3$, $I_1' = I_2$ and $I_2'' = I_3'$. That indicates that the experiment was performed correctly and the use of ammeters and connection of circuits was right.

CONCLUSION:

After performing this experiment, we have learnt a lot of things. We measured current using ammeter various times. Construction of complex circuits, knowledge of current divider rule, constancy of energy, the property of current interchange position without changing value — are learnt through this. Measured values verify the reciprocity theorem.

REFERENCE:

- ▣ "Introductory Circuit Analysis," Robert L. Boylestad
- ▣ "A Textbook of Electrical Technology," B. L. Theraja
- ▣ <https://www.wikipedia.org>