



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with ‘A++’(III Cycle) Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB101 – CIRCUIT ANALYSIS AND DEVICES

I YEAR/ II SEMESTER

UNIT 2 – NETWORK THEOREMS AND SOURCE TRANSFORMATION

TOPIC - Reciprocity Theorem



Reciprocity Theorem



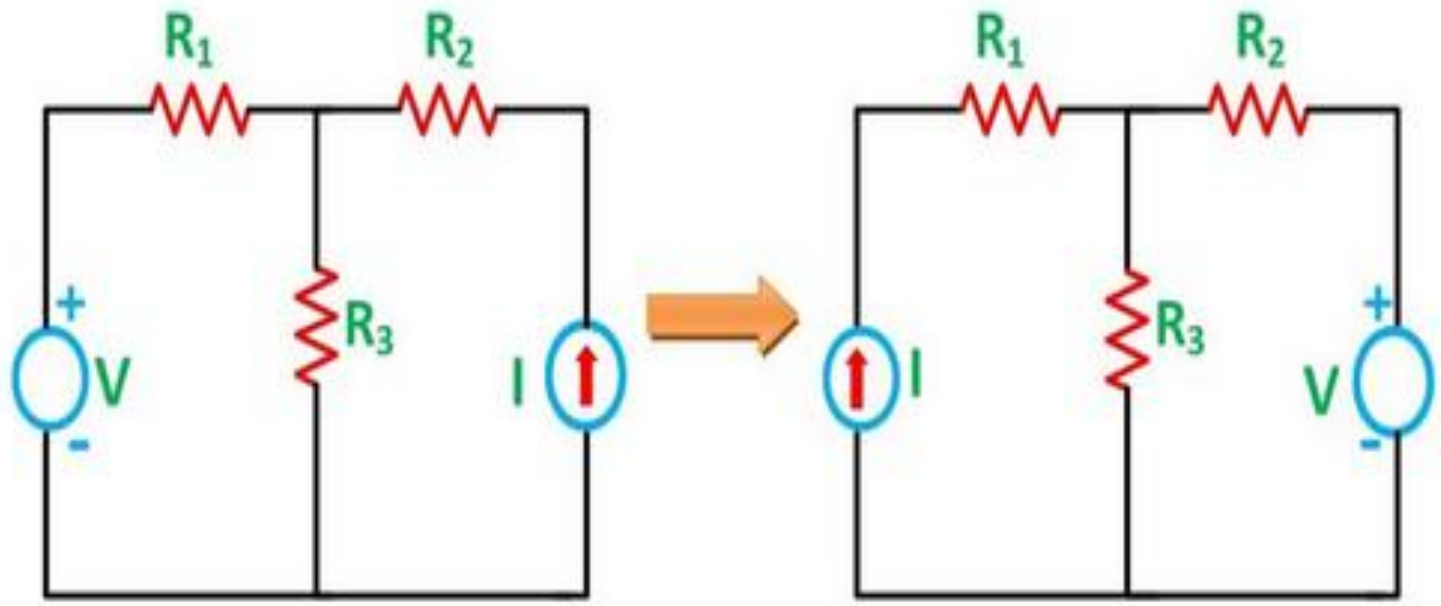
- **Reciprocity Theorem** states that – In any branch of a network or circuit, the current due to a single source of voltage (V) in the network is equal to the current through that branch in which the source was originally placed when the source is again put in the branch in which the current was originally obtained. This theorem is used in the bilateral linear network which consists bilateral components.



- The location of the voltage source and current source may be interchanged without a change in current. However, the polarity of the voltage source should be identical with the direction of the branch current in each position.
- This theorem is used for solving many DC and AC network which have many applications in electromagnetism electronics. Their circuit does not have any time varying element.



The Reciprocity Theorem is explained with the help of the circuit diagram shown below





steps involved in solving a problem using reciprocity theorem:

- **Step 1** – Firstly, select the branches between which reciprocity has to be established.
- **Step 2** – The current in the branch is obtained using any conventional network analysis method.
- **Step 3** – The voltage source is interchanged between the branch which is selected.



Step 4 – The current in the branch where voltage source was existing earlier is calculated.

- **Step 5** – Now, it is seen that the current obtained in the previous connection, i.e., in step 2 and the current which is calculated when the source is interchanged, i.e., in step 4 are identical to each other.



Limitations of Reciprocity Theorem:

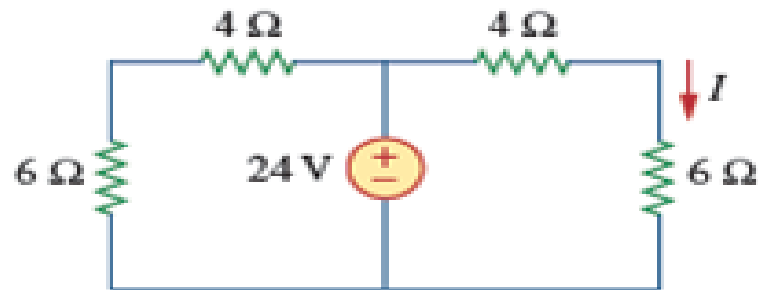


- The limitation of this theorem is that it is applicable only to single source networks and not in the multi-source network.
- The network where reciprocity theorem is applied should be linear and consist of resistors, inductors, capacitors and coupled circuits.
- The circuit should not have any time-varying elements.

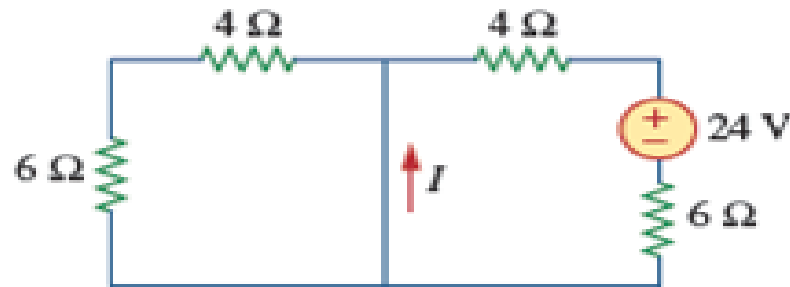


Example

For the circuit in fig a and b determine the current I and is the reciprocity theorem satisfied



(a)



(b)



- For fig a $I = 24/10 = 2.4 \text{ A}$
- For fig b $I = 24/10 = 2.4 \text{ A}$
- Hence reciprocity theorem is verified



THANK YOU