Electrical Technology (EE-101F)

Contents

- Superposition Theorem
- Nortens Theorem
- Analysis using examples
- Test your self
- NPTEL Link

Superposition Theorem

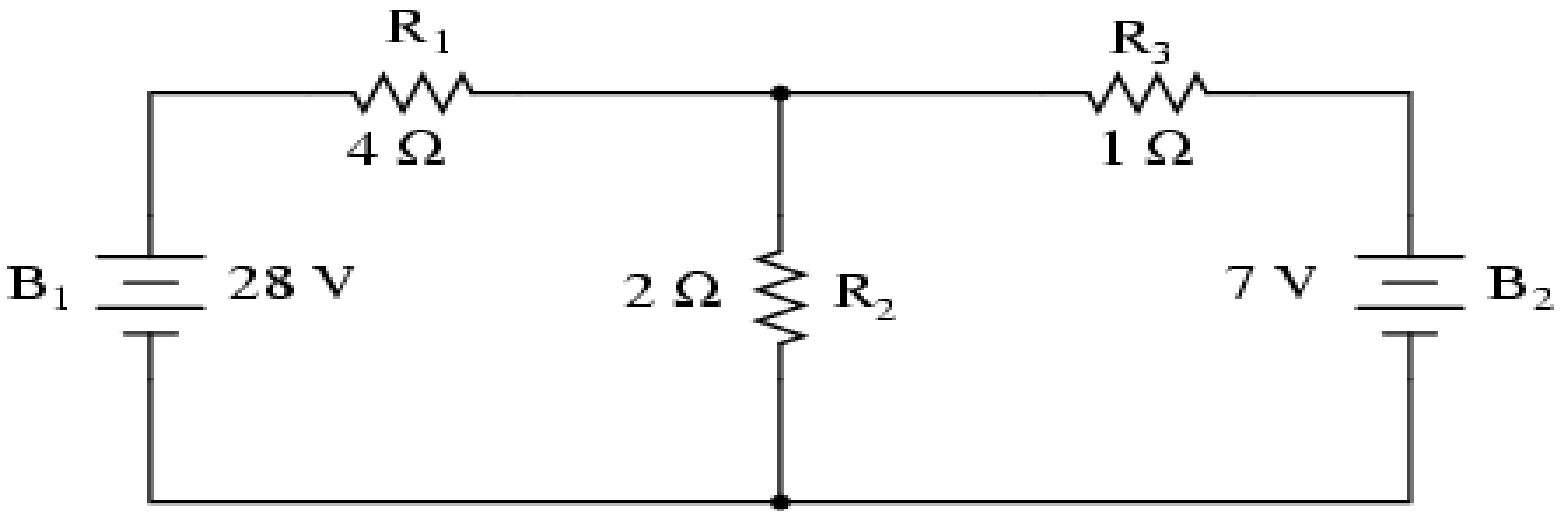
- Used to find the solution to networks with two or more sources that are not in series or parallel.
- The current through, or voltage across, an element in a network is equal to the algebraic sum of the currents or voltages produced independently by each source.
- Since the effect of each source will be determined independently, the number of networks to be analyzed will equal the number of sources.

Superposition Theorem

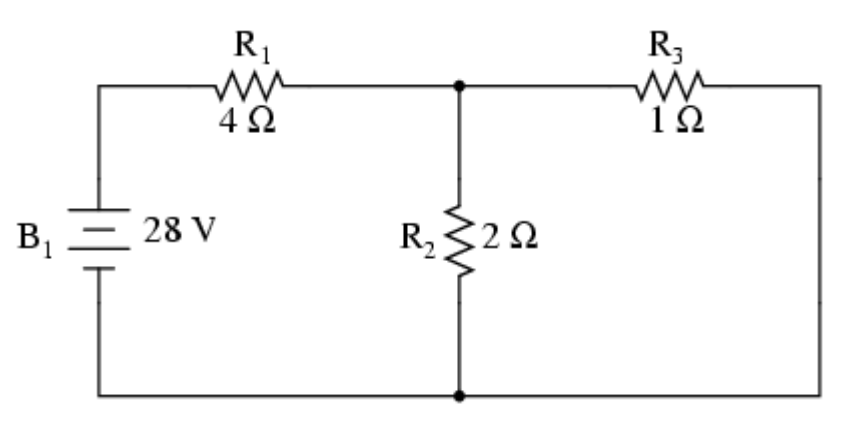
- The total power delivered to a resistive element must be determined using the total current through or the total voltage across the element and cannot be determined by a simple sum of the power levels established by each source.

Ex on Superposition Theorem

- There are two sources of power in this circuit .We will have to calculate two sets of values for voltage drops and/or current one for circuit with only 28 V battery and one for the circuit with only 7V battery.

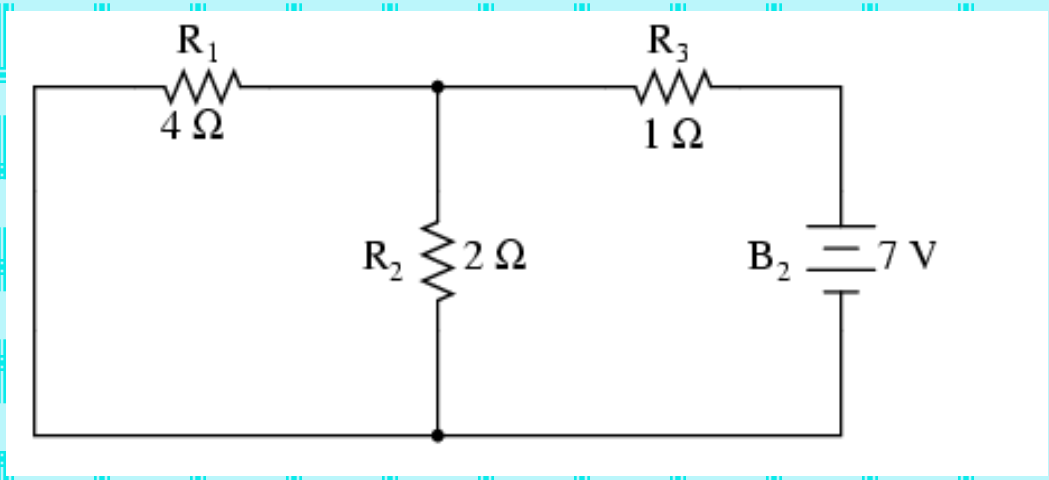


♦Circuit with 28V battery.



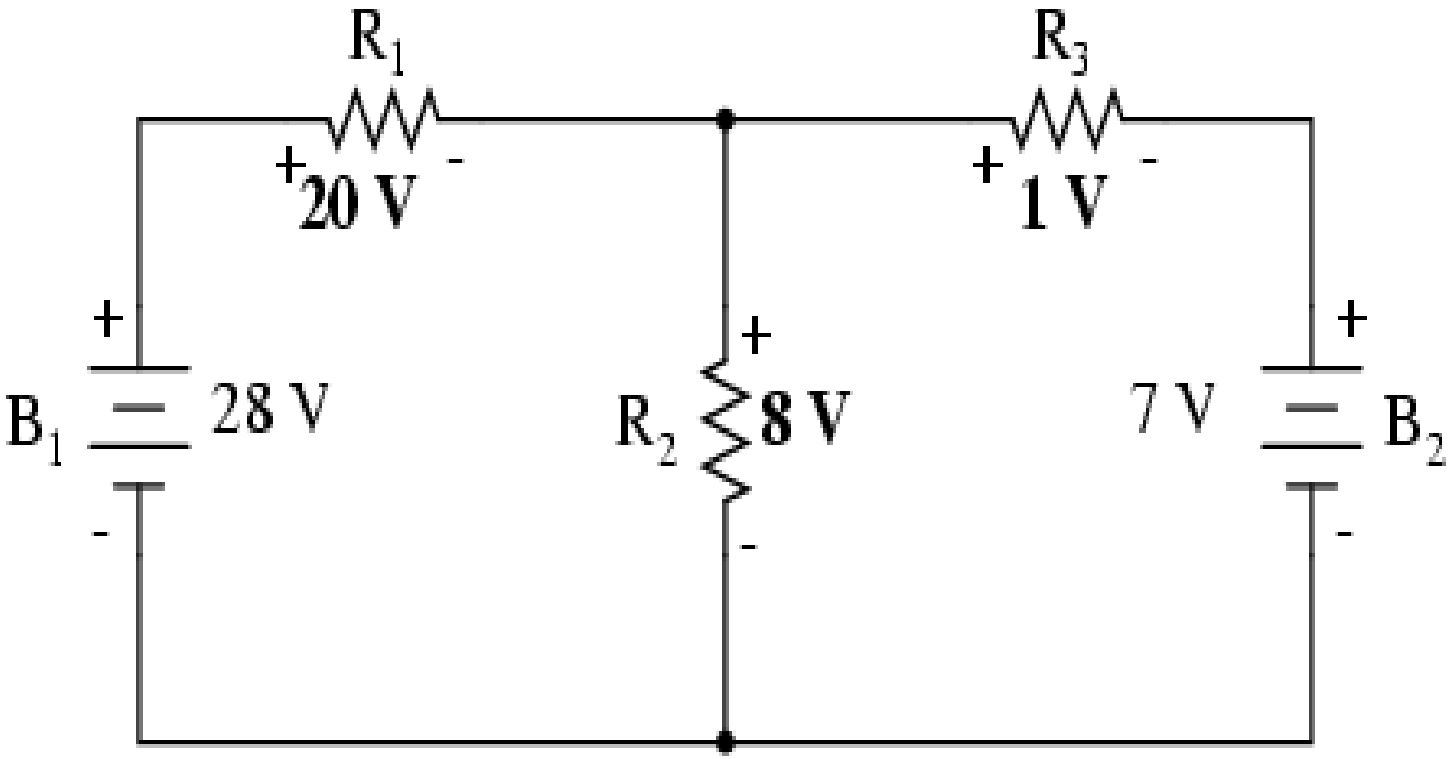
	R_1	R_2	R_3	$R_2//R_3$	$R_1 + R_2//R_3$ Total	
E	24	4	4	4	28	Volts
I	6	2	4	6	6	Amps
R	4	2	1	0.667	4.667	Ohms

- Circuit with 7V battery.



	R_1	R_2	R_3	$R_1//R_2$	$R_3 + R_1//R_2$ Total	
E	4	4	3	4	7	Volts
I	1	2	3	3	3	Amps
R	4	2	1	1.333	2.333	Ohms

Algebrically added voltages in the circuit



Assignment

- State and explain Superposition Theorem

–Norton's Theorem

- Norton's theorem states the following:
  - Any two-terminal linear bilateral dc network can be replaced by an equivalent circuit consisting of a current and a parallel resistor.
- The steps leading to the proper values of I_N and R_N.
- Preliminary steps:

1. Remove that portion of the network across which the Norton equivalent circuit is found.
2. Mark the terminals of the remaining two-terminal network.

Norton's Theorem

- Finding R_N:

3. Calculate R_N by first setting all sources to zero (voltage sources are replaced with short circuits, and current sources with open circuits) and then finding the resultant resistance between the two marked terminals. (If the internal resistance of the voltage and/or current sources is included in the original network, it must remain when the sources are set to zero.) Since $R_N = R_{Th}$ the procedure and value obtained using the approach described for Thévenin's theorem will determine the proper value of R_N.

Norton's Theorem

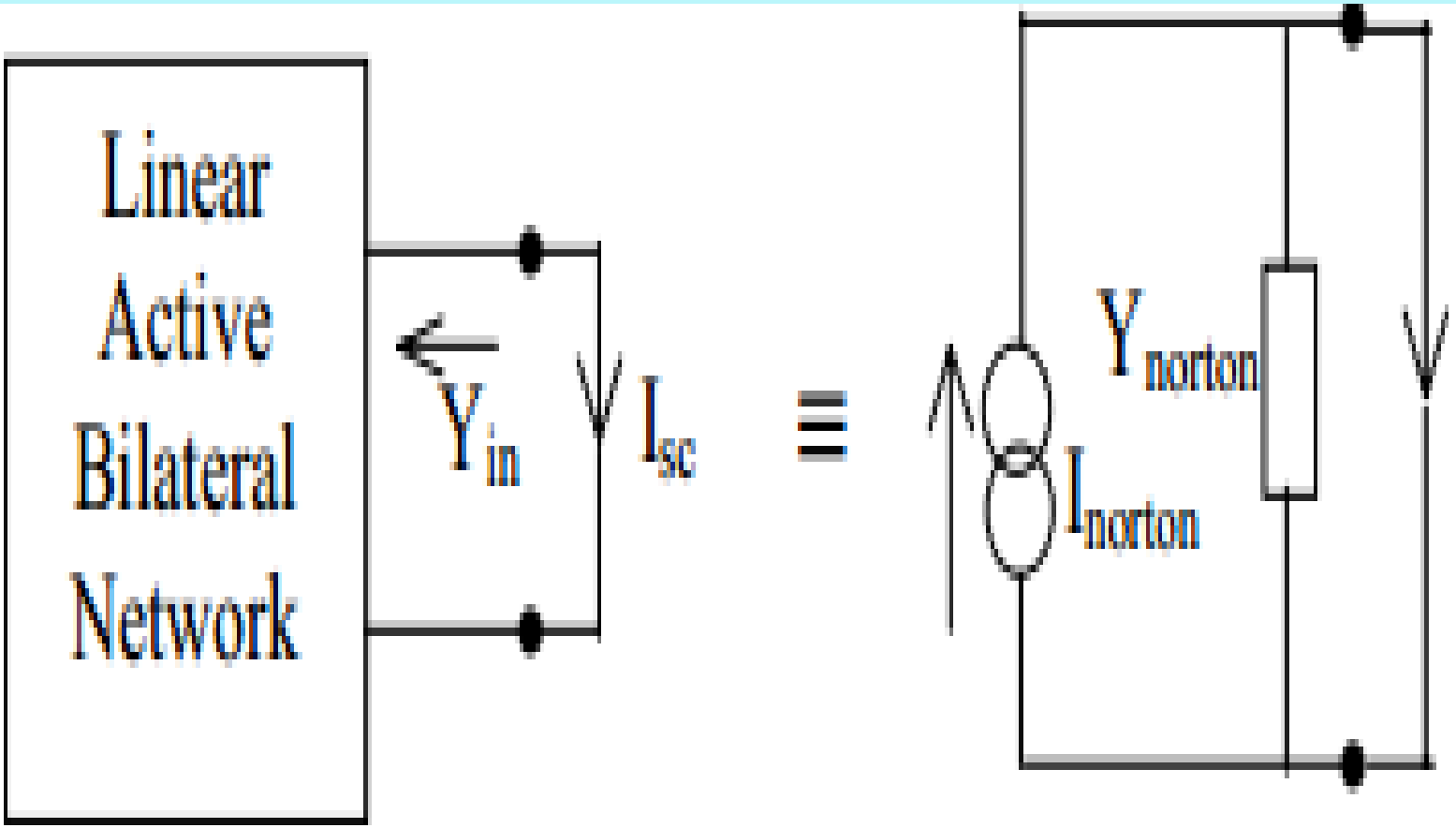
- Finding I_N :

4. Calculate I_N by first returning all the sources to their original position and then finding the short-circuit current between the marked terminals. It is the same current that would be measured by an ammeter placed between the marked terminals.

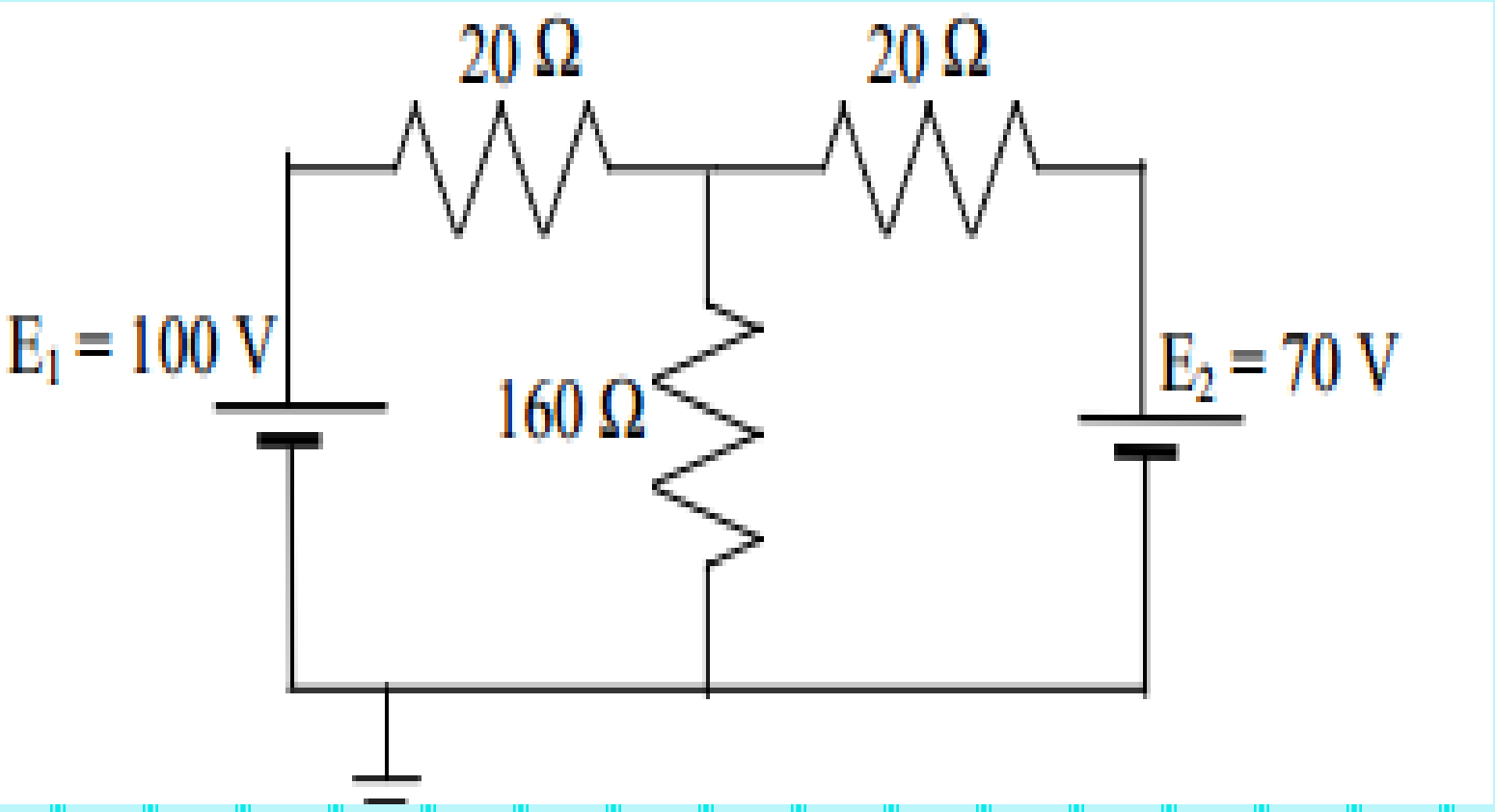
- Conclusion:

5. Draw the Norton equivalent circuit with the portion of the circuit previously removed replaced between the terminals of the equivalent circuit.

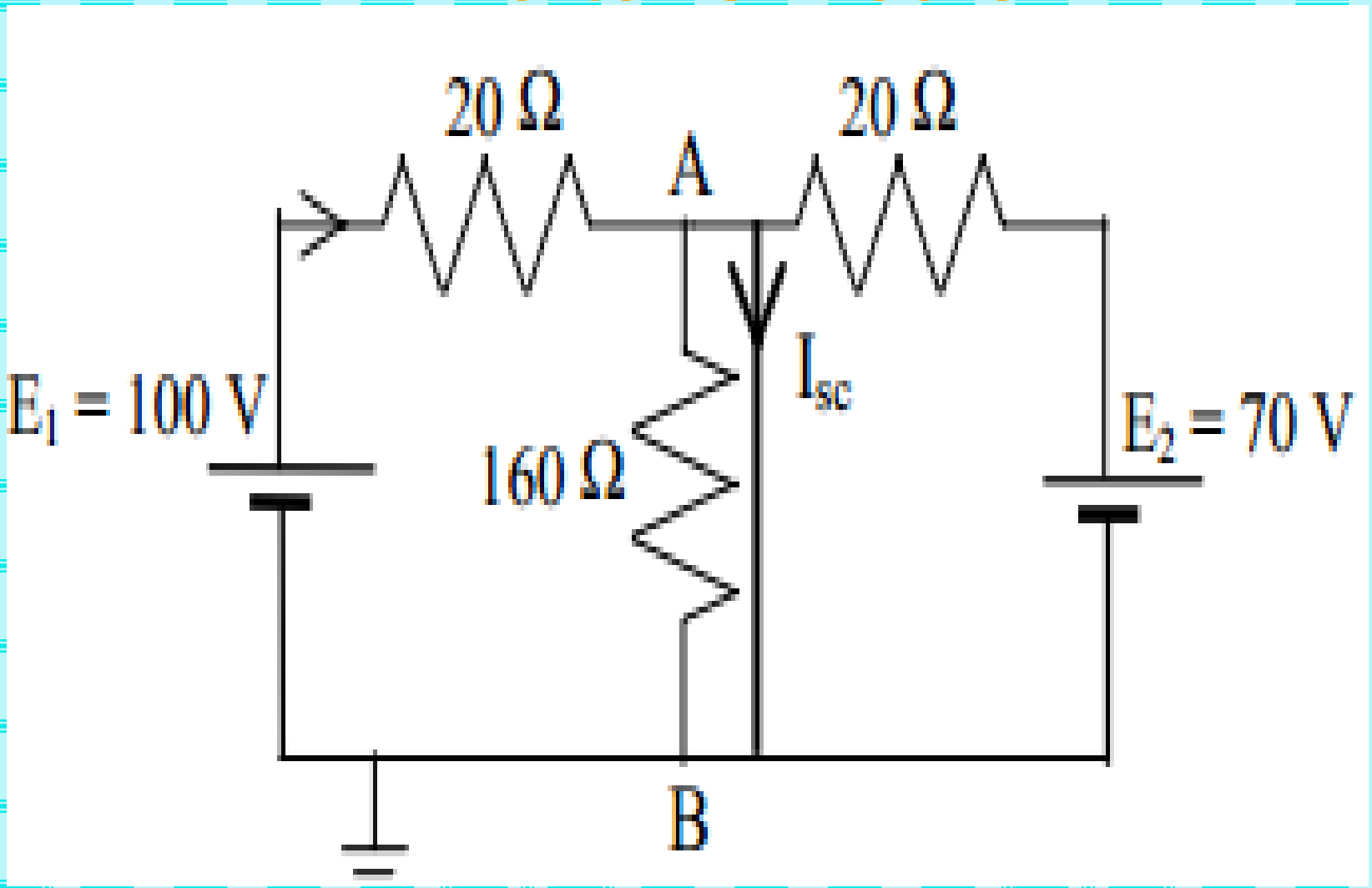
Norton's Theorem



Ex Norton's Theorem



Ex Norton's Theorem



Ex Norton's Theorem