Experiment No.9

Superposition Theorems

Object

To apply superposition theorem to a D.C electric circuit.

Theory

This theorem states that: "In a network of a linear resistance's containing more than one sources, the current which flows at any point is the sum of the currents which would flow that point if each source were considered separately and all the other voltage sources replaced for the time being by short circuit"

For example: the network shown in Figure (1) curtains two voltage sources $E_1$and E_2, if it is required to find the branch currents I_1, $I_2$and $I_3$with the directions shown in Figure (1).

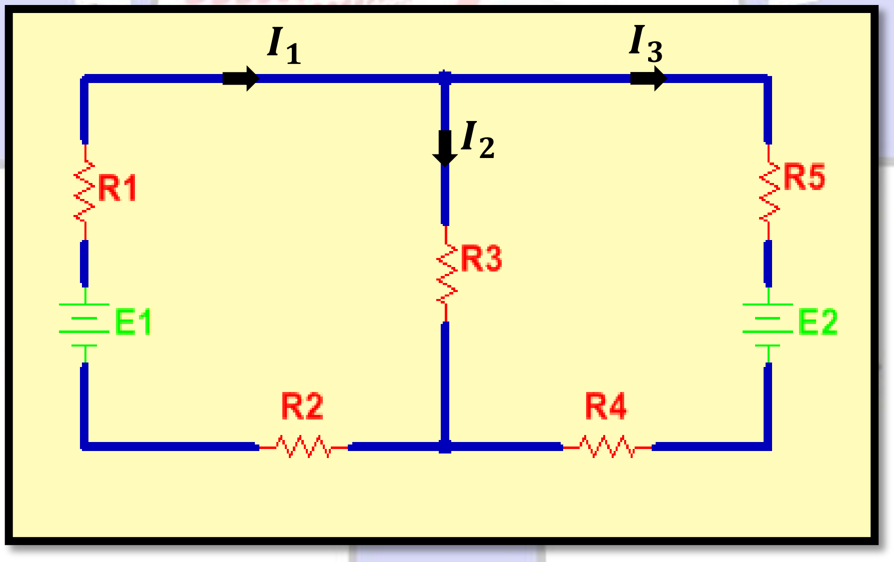

Fig.1

Figure (2) shows the branch currents I_1, $I_2$and I_3 when the voltage source E_1 is replaced by short circuit. Figure (3) shows the branch currents I_1, $I_2$and I_3 when the voltage source E_2 is replaced by short circuit.

Now, according to the superposition theorem, if the branch currents according to the effect of each voltage source are in the same direction, then the resulted current is sum of two currents in the direction of either current. But if the individual currents are in opposite direction through the same branch, the resulting currents is the difference of the two and has the direction of the larger.

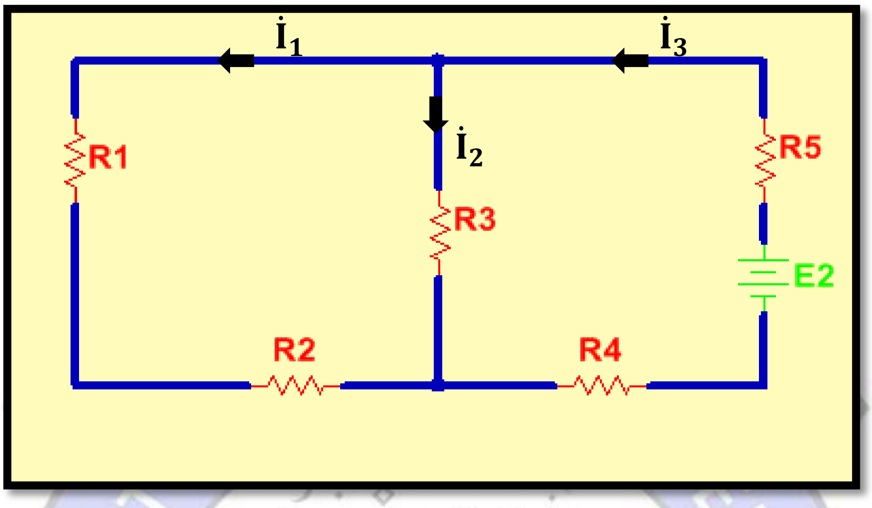

Fig.2

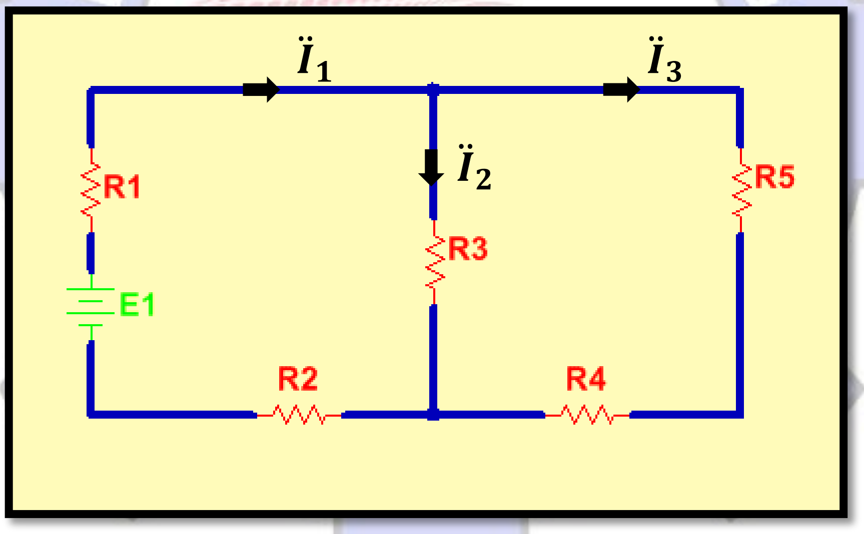

Fig.3

So

$$I_1 = \dot{I}_1 - \ddot{I}_1$$

$$I_2 = \dot{I}_2 + \ddot{I}_2$$

$$I_3 = \dot{I}_3 - \ddot{I}_3$$

Apparatus

1. Set of resistors
2. Two power supply units.
3. Voltmeter
4. Ammeter

Procedure

1. Connect the circuit as shown in Figure (4).
2. Measure the voltage across (2.3kΩ, 1kΩ, and 2.2kΩ). resistors respectively; record your results in the second column of Table (1).
   Note: consider the polarity of the voltages
3. Leave $E_1$and replace E_2 by short circuit, repeat step 1 and record. your results in the third column of Table (1).
4. Leave $E_2$and replace $E_1$by short circuit, repeat step 1 and record your results in the fourth column of Table (1).
5. Find the value of V which is equal to ($\dot{V} = \ddot{V}$) record the results in the fifth column of Table (1) and compare them with the firs column of Table (1).

R Ω	Fig.4 V(Volt)	E_2 is short V(Volt)	E_1 is short V(Volt)	$\dot{V} + \ddot{V}$ V(Volt)
2.2k				
1k				
2.3k				

Table (1) Practical Results

Discussion

1. Calculate theoretically using superposition theorem the voltage across each resistor in Figure (4) record your results in Table (2).
2. Compare between the practical and theoretical results.
3. For the network shown in Figure (5), Find the voltage across the points A and B using superposition theorem.

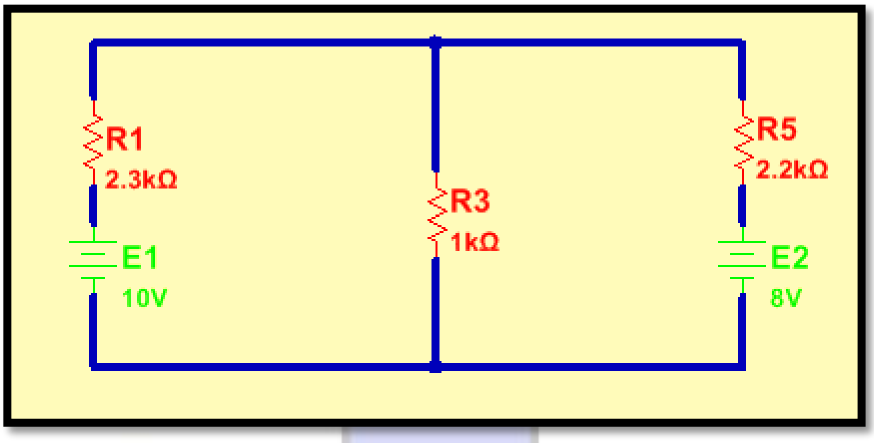

Fig.4

R Ω	E_2 is short V(Volt)	E_1 is short V(Volt)	$\dot{V} + \ddot{V}$ V(Volt)
2.2k			
1k			
2.3k			

Table (2) Theoretical Results

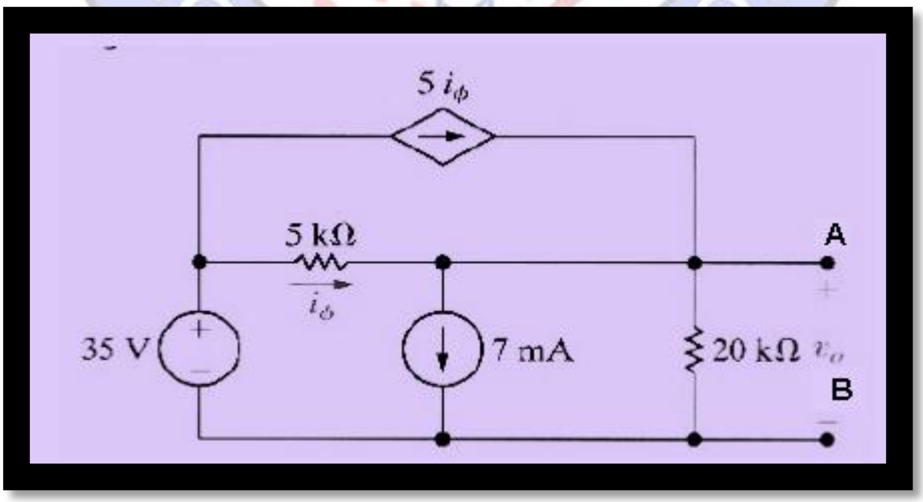

Fig.5