Verification of Network Theorems

Exp. No: **Date:**

Aim: To verify the 1. Thevenin's Theorem

2. Superposition Theorem

Thevenin's Theorem

Apparatus required:

S.No	Name of the equipment	Range/ Specification	Type	Quantity
1	Resistors		Carbon composite	4
2	Bread board	30V, 1A	-	1
3	Regulated power supply	(0-30)V, 2A	-	1
4	Multimeter		Digital	1
5	Connecting wires	1/22 guage	Copper	Adequate

Procedure:

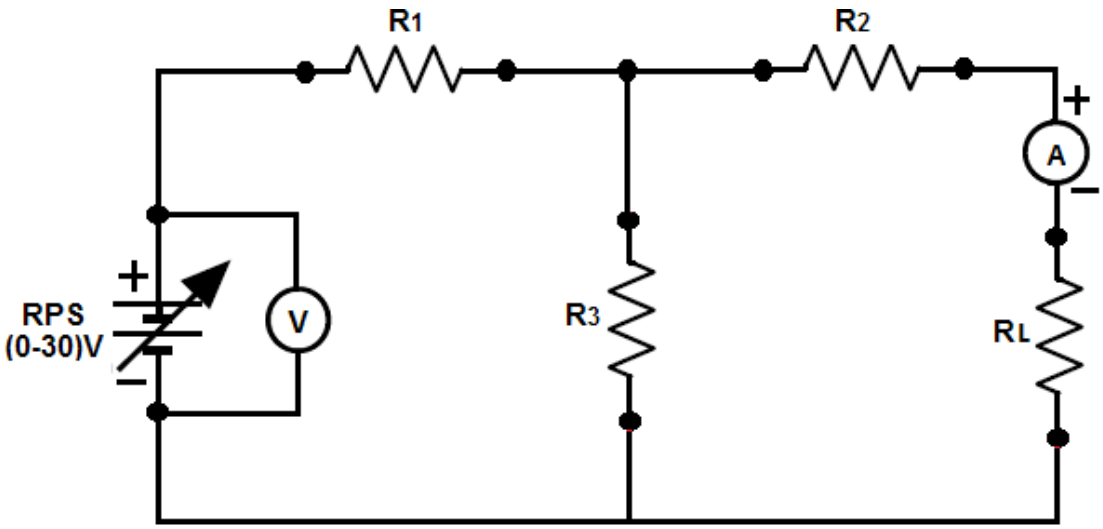
1. Connect the circuit as shown in fig 1(a)
2. Switch on the RPS and apply some input voltage (say 5V), observe the **load current (I_L)**.
3. Now reconnect the circuit as shown in Fig 1(b) and apply the same input voltage as in step 2 and observe the **Short circuit current (I_{SC}).**
4. Now reconnect the circuit as shown in fig1 (c) and apply the same input Voltage as in step 2 and observe the **Open circuit voltage (V_{OC})** which is nothing but the thevenin's voltage **(V_{Th}).**
5. Now compute the thevenin's equivalent resistance

   $R_{Th}= V_{Th}/I_{SC}$.
6. Compute the load current applying thevenin's theorem as

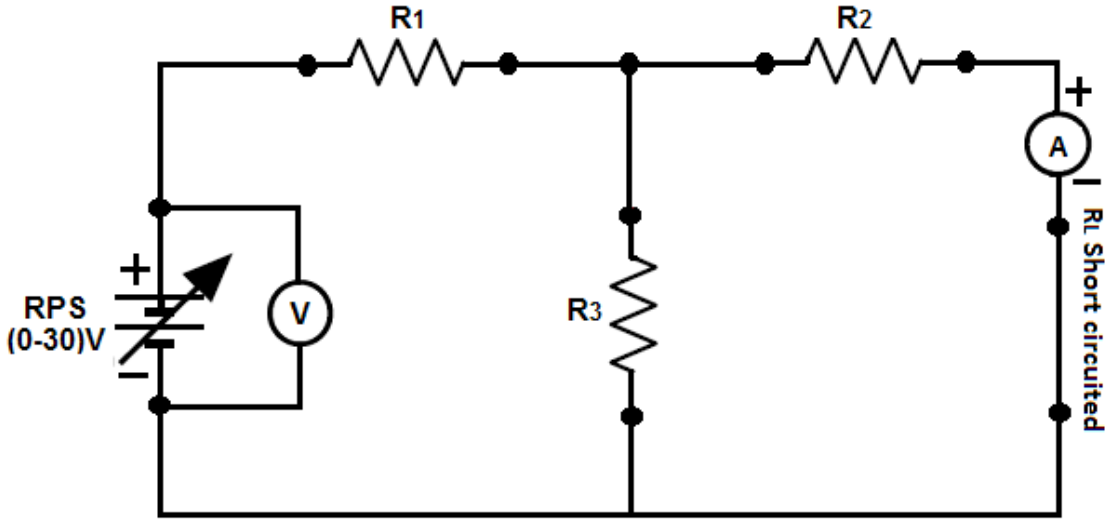
   $I_L=V_{Th}/(R_{Th}+R_L)$.

7. Compare the above load current with its observed value in step (2) and verify the theorem.
8. Adjust the input voltage to a new value and repeat the procedure from step (2) to step (7) Take at least five sets of readings.

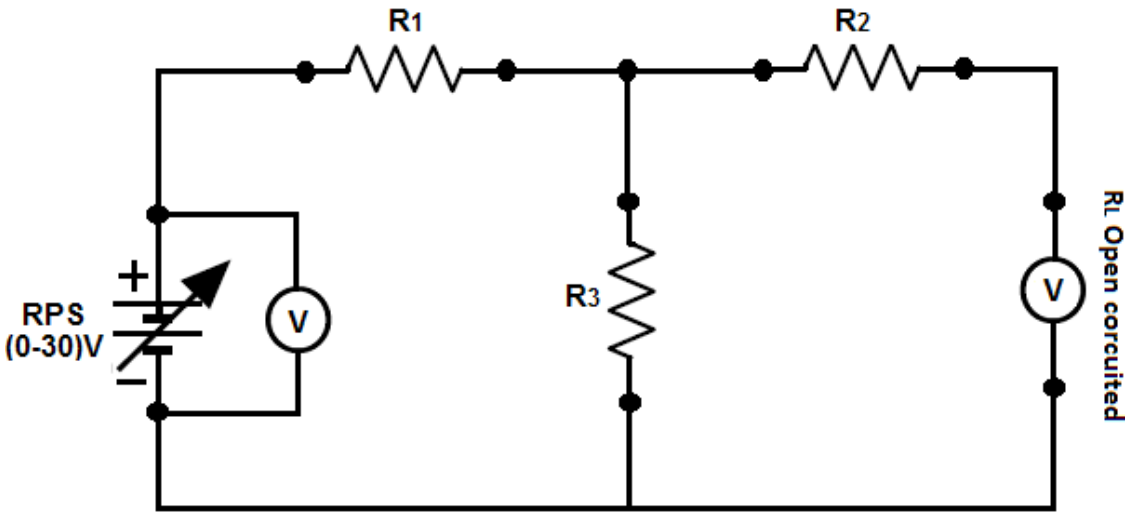
Circuit diagram:



Circuit diagram for Load current (I_L)



Circuit diagram for Short circuit current (I_{sc})



Circuit diagram for Open circuit Voltage (V_{oc} OR V_L)

Tabular column:

S. No	V	Observed load current $\mathbf{I_L}$	I_{SC}	V_{Th} (OR) V_{oc}	Computed load current $I_L = V_{Th}/(R_{Th}+R_L)$	Error	% Error

Theoretical calculations:

$V_{Th} = I\,R_3$

- *I is the circuit current when R_L is removed*

$$I = \frac{V}{R_1 + R_2}$$

- *V_{Th} is the drop across R_3 when R_L is removed*

$R_{Th} = (R_1 // R_3) + R_2$ *(OR)* $R_{Th} = V_{Th} / I_{SC}$

$$I_{SC} = \frac{V_{Th}}{R_{Th}}$$

$$I_L = \frac{V_{Th}}{R_{Th}+R_L}$$

Precautions:

1. Set the current adjustment knob of the RPS in maximum position and voltage coarse and voltage fine adjustment knobs in minimum position.
2. While using multimeter as a voltmeter or ammeter insert the connecting probes in proper sockets.

Result:

Superposition Theorem

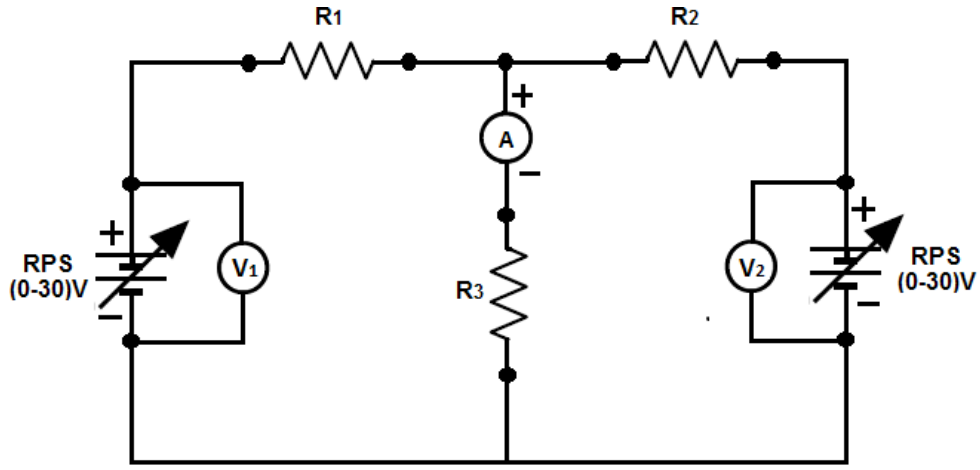
Aim: To verify Superposition Theorem

Apparatus required:

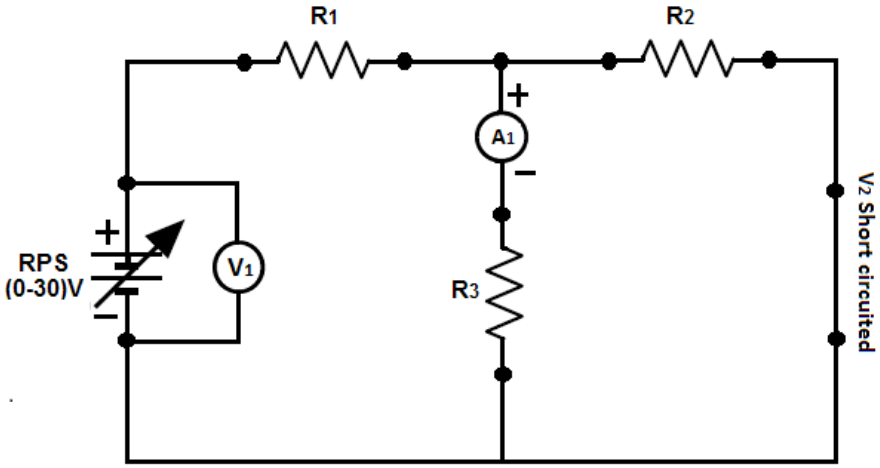
S.No	Name of the equipment	Range/ Specification	Type	Quantity
1	Resistors		Carbon composite	3
2	Bread board	30V, 1A	-	1
3	Regulated power supply	(0-30)V, 2A	-	1
4	Multimeter		Digital	1
5	Connecting wires	1/22 guage	Copper	Adequate

Procedure:

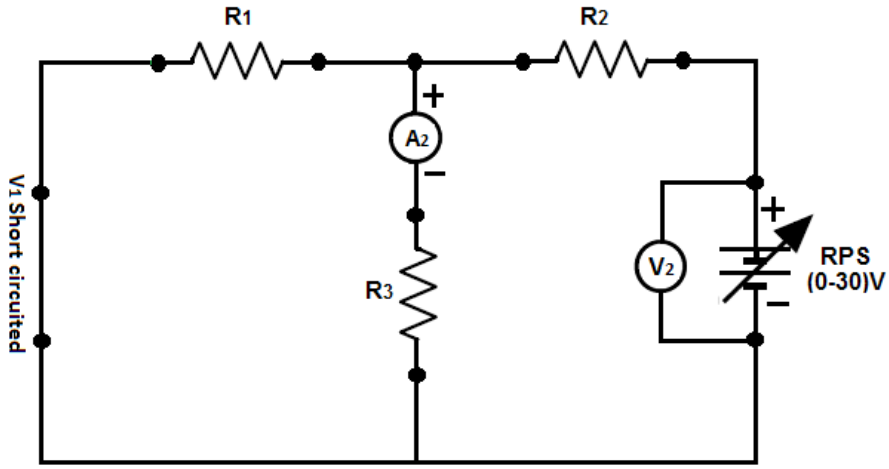
1. Connect the circuit as shown in the Fig 2(a), apply some input voltage V_1 resistor.
2. Connect the circuit as shown in fig 2(b), and apply the same voltage V_1 as in step1 and observe the current(I_1) through the 1kΩ resistor.
3. Connect the circuit as shown in fig 2(c), and apply the same voltage V_2 as in step1 and observe the current (I_2) through the 1kΩ resistor.
4. Compare I with (I_1+I_2) taking care of signs properly to verify the theorem.
5. Repeat the procedure from step1 to step4 for five different combinations of voltages V_1 and V_2



Circuit Diagram for I_L



Circuit Diagram for I_1



Circuit Diagram for I_2

Circuit diagram for super position theorem

Tabular column:

S. No	V_1	V_2	Observed load current $\mathbf{I_L}$	I_1	I_2	Computed load current $\mathbf{I_L}= I_1+I_2$	Error	% Error

Theoretical calculations:

$I_1 = V_1 / [(R_2 // R_3) + R_1]$

- I_1 is the circuit current when V_2 is replaced with its internal resistance

$I_2 = V_2 / [(R_1 // R_3) + R_2]$

- I_2 is the circuit current when V_1 is replaced with its internal resistance

$I_L = I_3 = I_1 + I_2$

Precautions:

1. Set the current adjustment knob of the RPS in maximum position and voltage coarse and voltage fine adjustment knobs in minimum position.
2. While using multimeter as a voltmeter or ammeter insert the connecting probes in proper sockets.

Result: