Experiment No.8

Norton's Theorems

Object

To prove Norton's theorem practically.

Theory

Norton's theorem states the following: "Any two terminal linear D.C network can be replaced by any equivalent circuit consisting of a constant current source (I_N) and a parallel resistance (R_N), as shown in Fig.1(a).

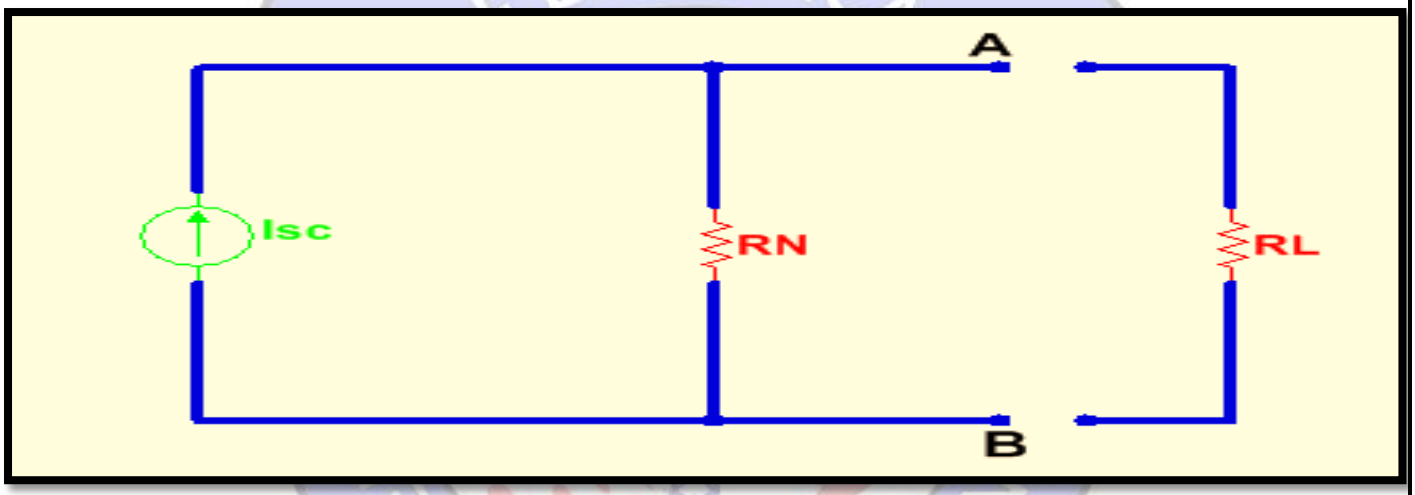


Fig.1(a) Equivalent circuit according to Norton theorem

The constant current is equal to the current which would flow in a short circuit placed across the terminals A and B as shown in Fig.1(b), and is called ($I_{SC} = I_N$).

Where:

I_{SC}: is the short circuit current.

I_N: is the Norton current.

The parallel resistance is the resistance of the network when viewed from A-B open terminals after all voltage and current has been removed and replaced by short or open circuits respectively, as shown in Fig.2

Then according to Fig.2, the current through R_L (when R_L is connected to Norton equivalent circuit) will be:

$$I_L = I_N * R_N/(R_N + R_L)$$

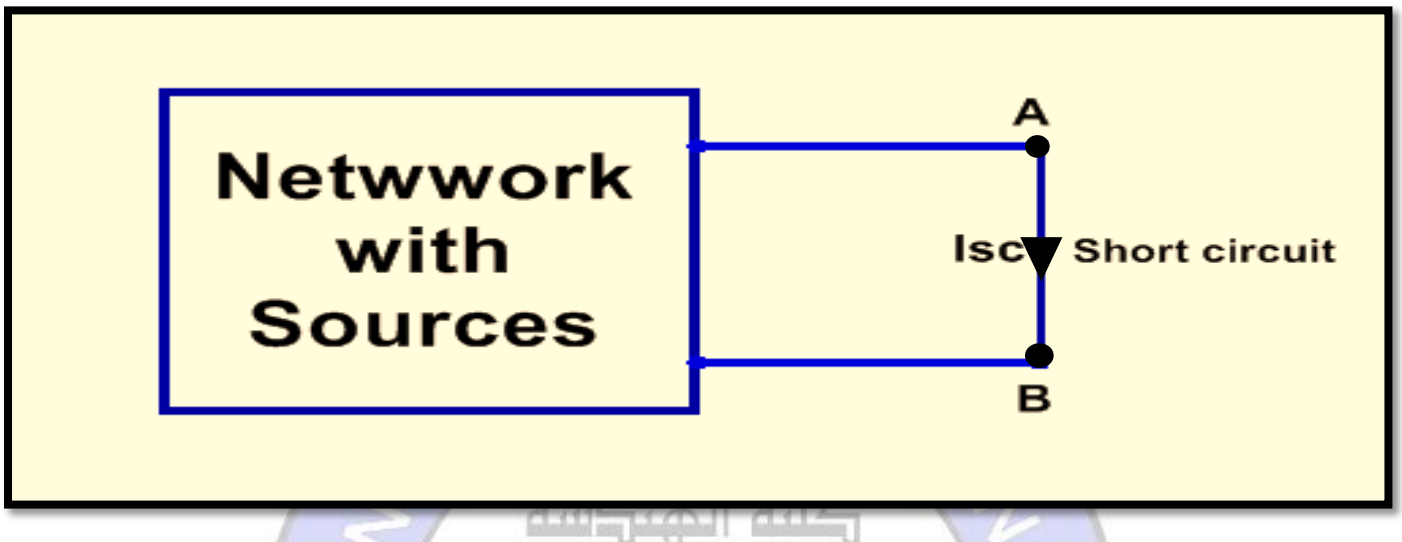


Fig.1(b) Calculating the constant current source $I_{SC} = I_N$

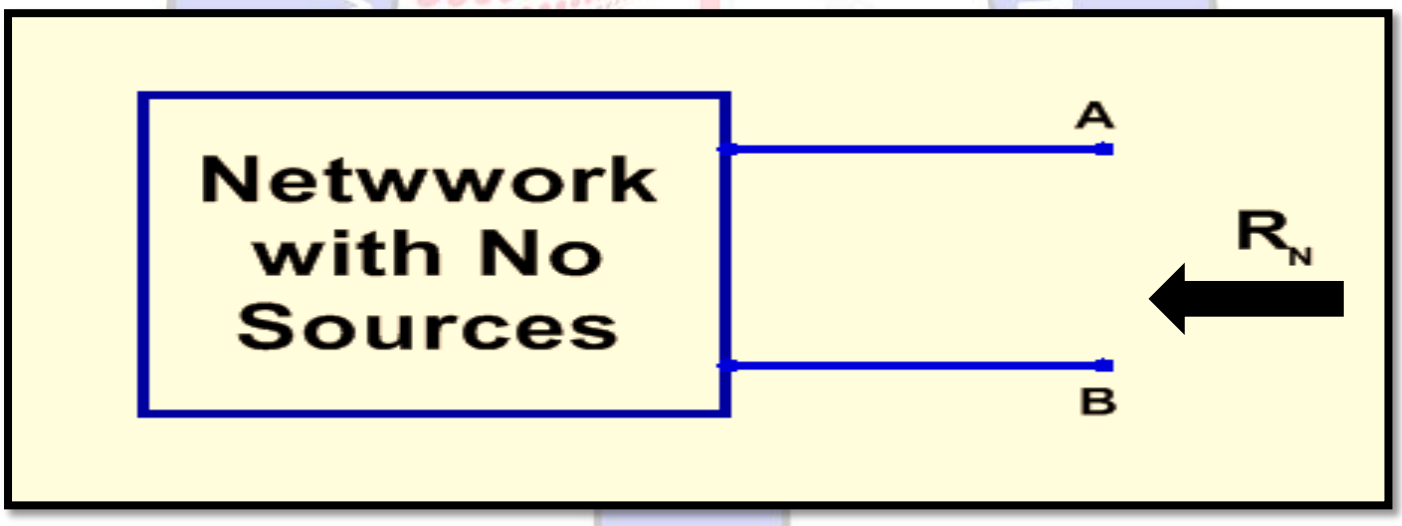


Fig.1(c) Calculating the equivalent parallel resistance R_N

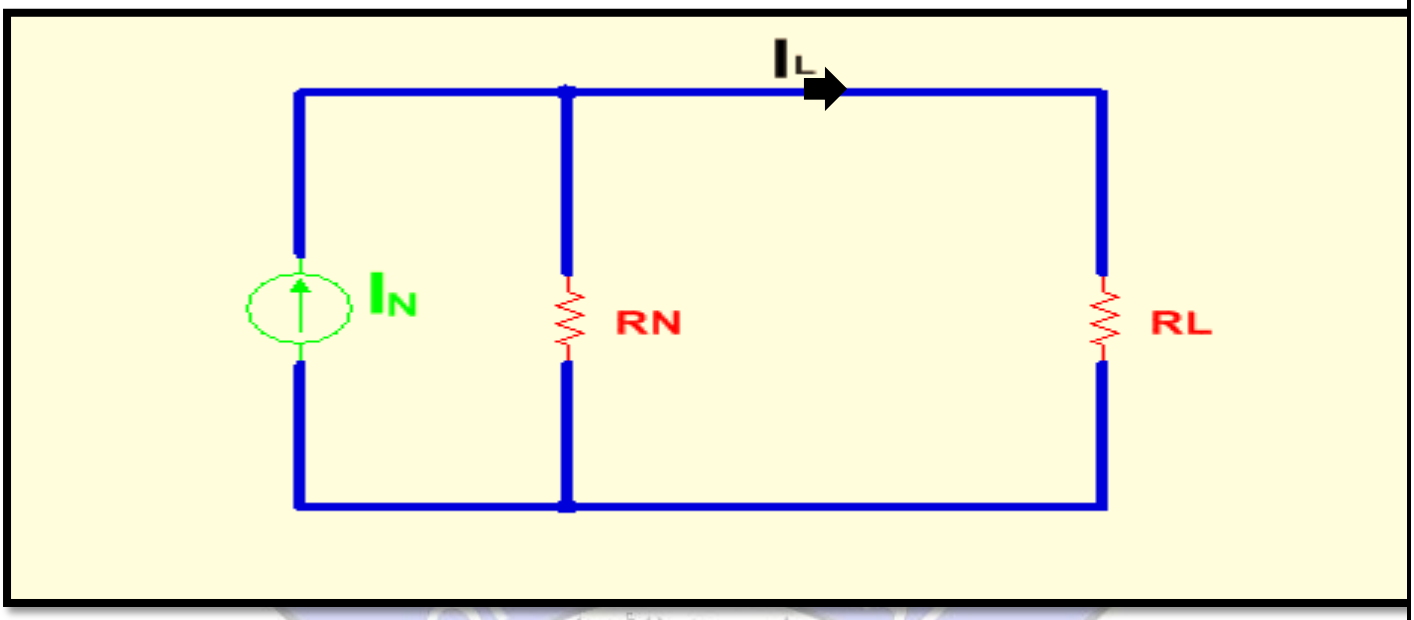


Fig.2 The equivalent Norton circuit with R_L

Apparatus

1. Power supply
2. AVO meter
3. Four resistors

Procedure

1. Connect the circuit as shown in Fig.3

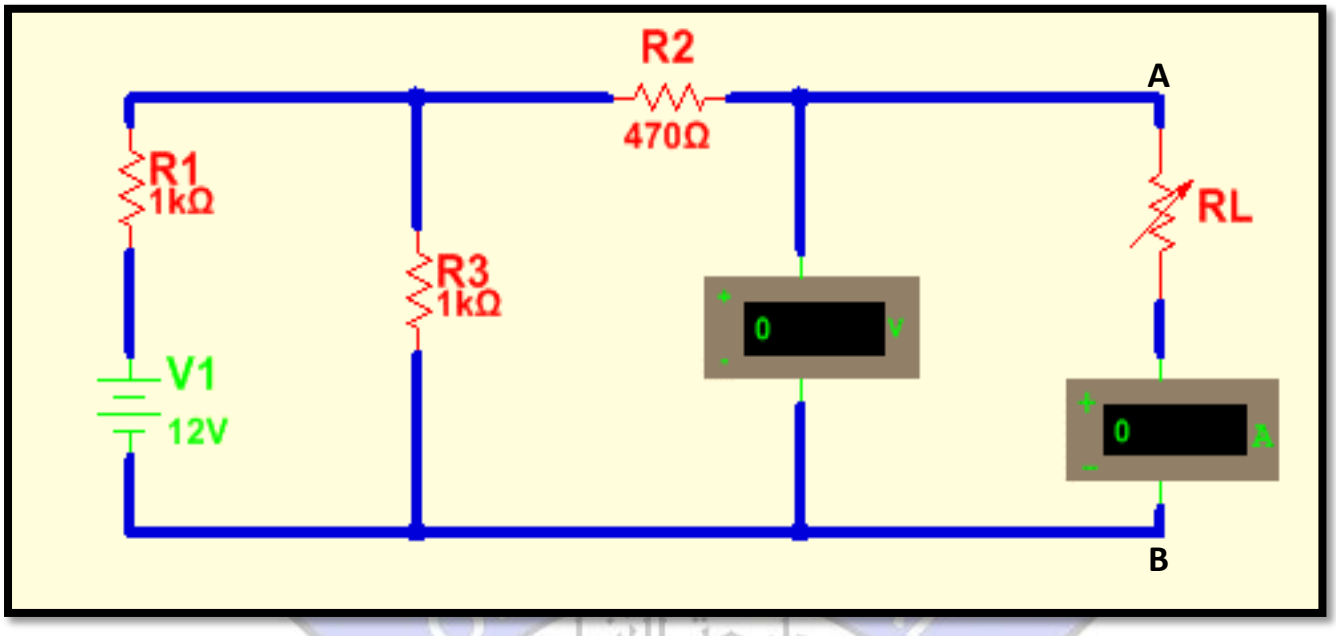


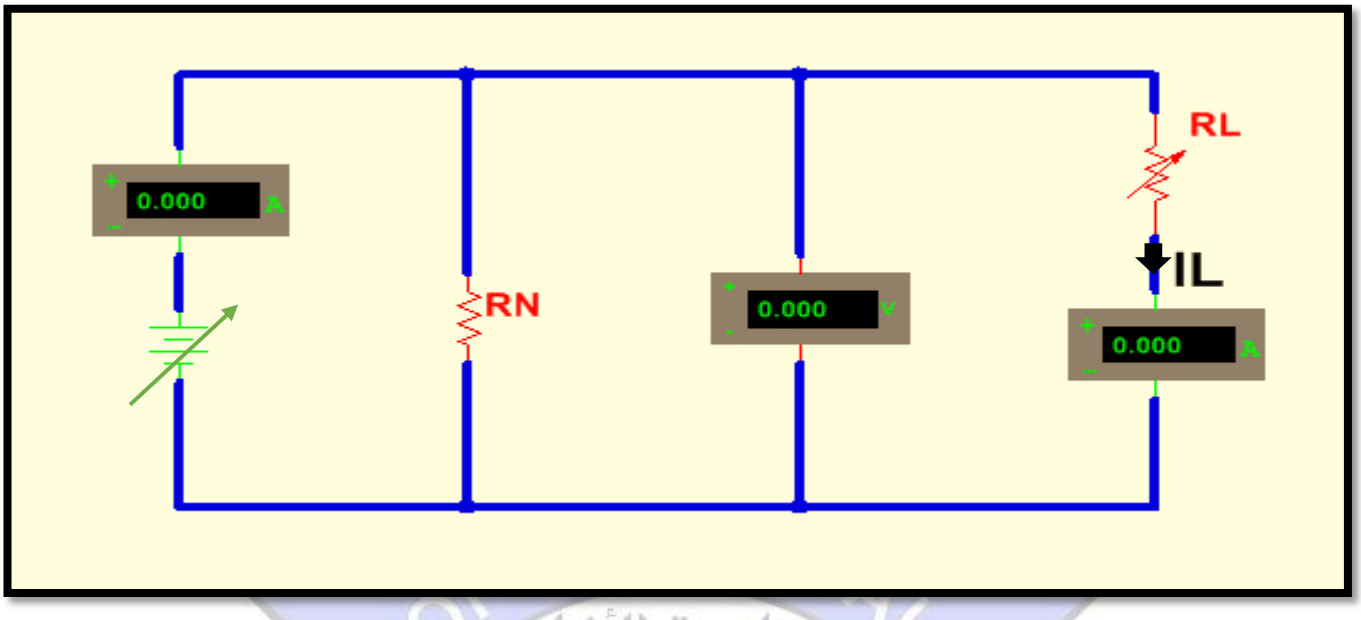
Fig.3

2. Vary R_L resistance as shown in Table (1), measured I_L and V_L in each step, Record your results in the second and third column of Table (1).

R_L Ω	Fig.3		Fig.4	
	I_L(mA)	V_L(Volt)	I_L(mA)	V_L(Volt)
400				
500				
600				
700				
800				

Table.1 Practical Result

3. Disconnect R_L, then measure the short circuit current (I_{SC}) between A and B terminals.
4. Calculate R_N theoretically and connect Norton equivalent circuit as shown in Fig.4. Make sure that the constant current source is remains constant in each step of varying R_L, by means of varying the D.C power supply.



5. Repeat step (2) and record your results in the fourth and fifth column of Table (1).

R_L Ω	Fig.3		Fig.4	
	I_L(mA)	V_L(Volt)	I_L(mA)	V_L(Volt)
400				
500				
600				
700				
800				

Table.2 Theorical Result

Discussion

1. Calculate It and Vi theoretically from Fig.3 and Fig.4, then record your results in Table (2)
2. Compare briefly between the practical and theoretical results.

3. Find the voltage between the open terminals A and B for the network shown in Fig.5 using Norton theorem. And the value of R_L is one half the value of R_N, find the current through R_L

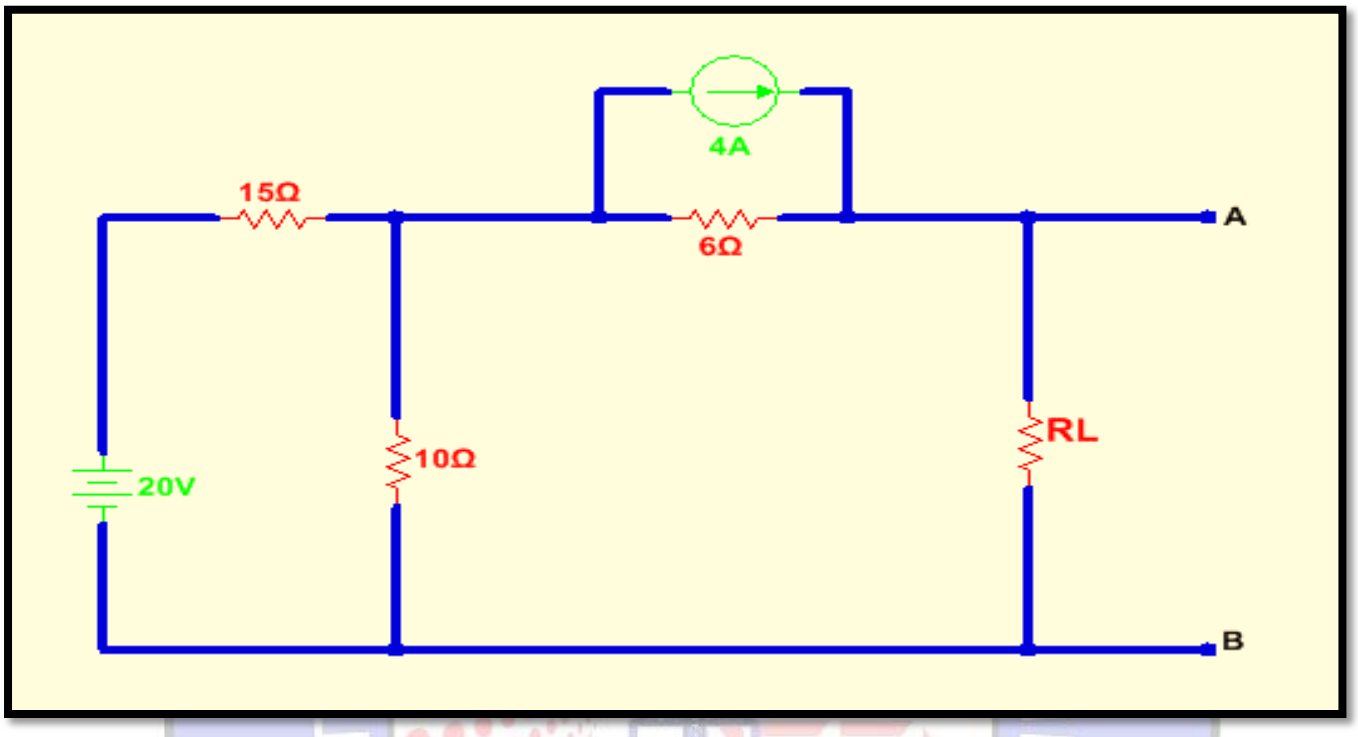


Fig.5