Experiment No.6

Thevenin's Theorems

Object

To study and apply Thevenin theorem to Eclectic circuit.

Theory

Thevenin's theorem states the following: "Any Two-terminals of 1inear D.C network can be replaced by a single voltage source E_{th} With a series resistance (R_{th}). It makes the solution of a complicated e1ectric network quite quick and easy .

The application of this theorem will be explaned with the help of the following simple example.

If it is required to find the current following through load resistance R_L as shown in Fig.1(a), the following steps will be handled :

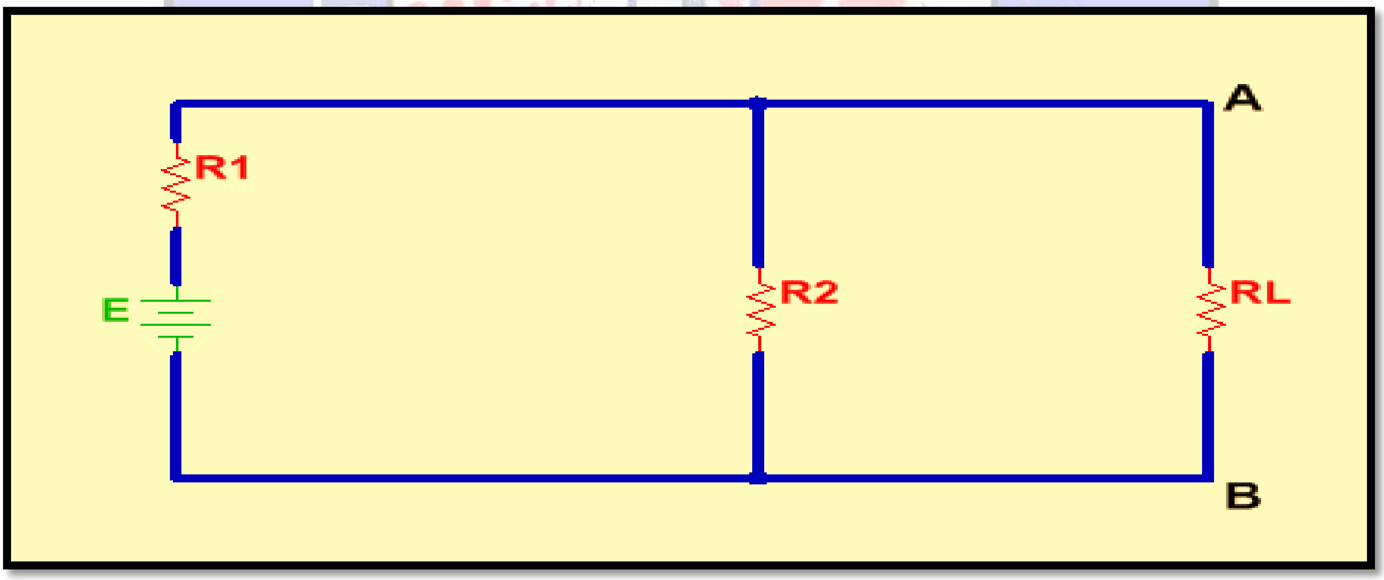

Fig.1(a) The active network with R_L

1. Remove R_L from the circuit terminal A and B and redraw the circuit as shown in Fig1(b). Observably the terminal A-B has become an Open circuit.

2. Calculate the. Open circuit voltage ($V_{OC} = E_{th}$) which appears across terminals A and B.
   As shown in Fig.1(b), $V_{OC} = E_{th}$=voltage drop across R_2

   Where:

   $V_{R2} = IR_2$ where (I) is the circuit current

   $I = E/(R_1 + R_2)$

   V_{R2}=$V_{OC} = E_{th} = IR_2 = E * R_2/(R_1 + R_2)$

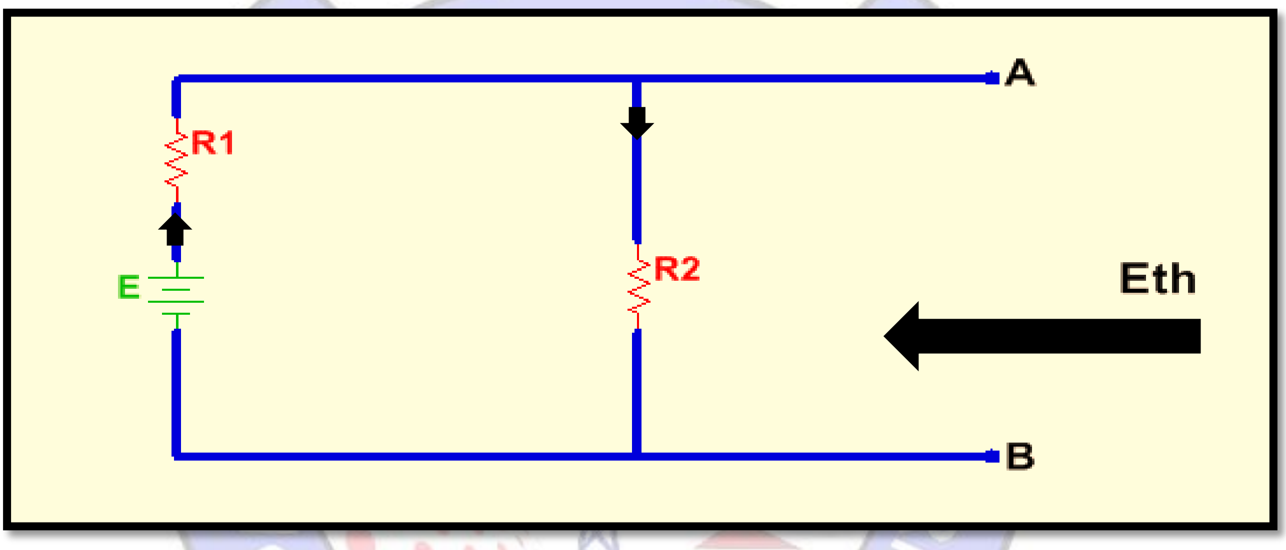

Fig.1(b) The equivalent circuit according to the Thevenin Theorem

3. Replace the voltage source by short circuit and redraw circuit as shown in Fig.1(c) when viewed through terminals A and B, the circuit consist of two parallel resistance's (R_1 *and* R_2). The equivalent resistance of the network is called Thevenin resistance (R_{th}) or open circuit resistance (R_0).
   R_{th}=$R_1 \parallel R_2 = (R_1 * R_2)/(R_1 + R_2)$

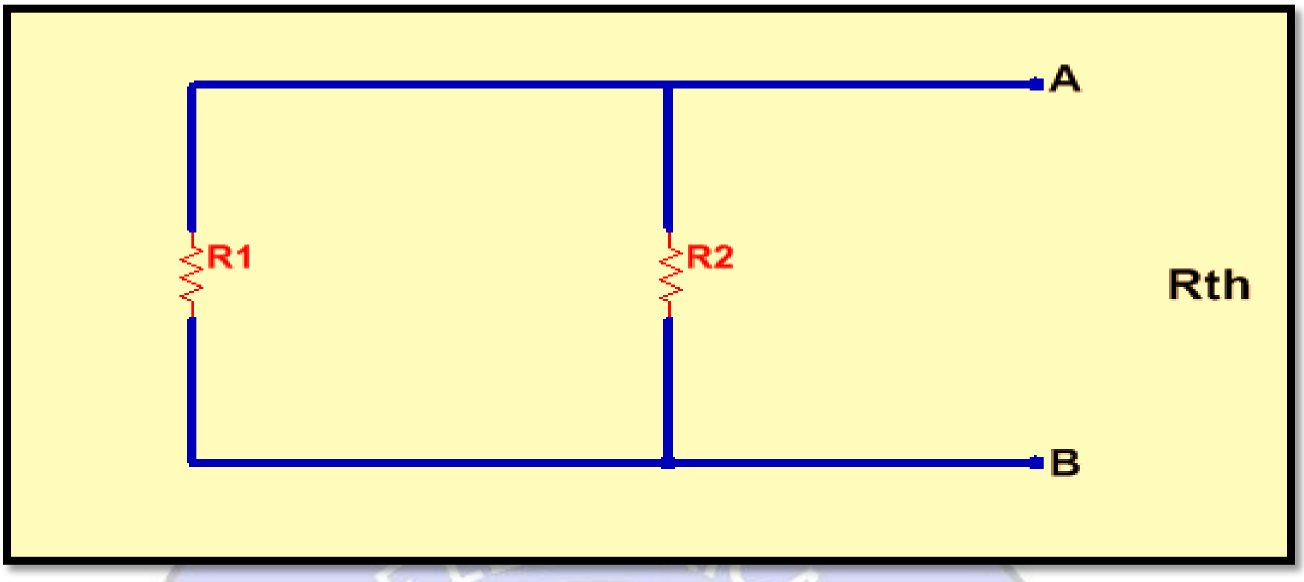

Fig.1(c) The equivalent circuit according to the Thevenin Theorem

4. R_L is now connected back across terminals A and B from whree it was temporally removed earlier. As shown in Fig.2, the current flowing through R_L is given by:

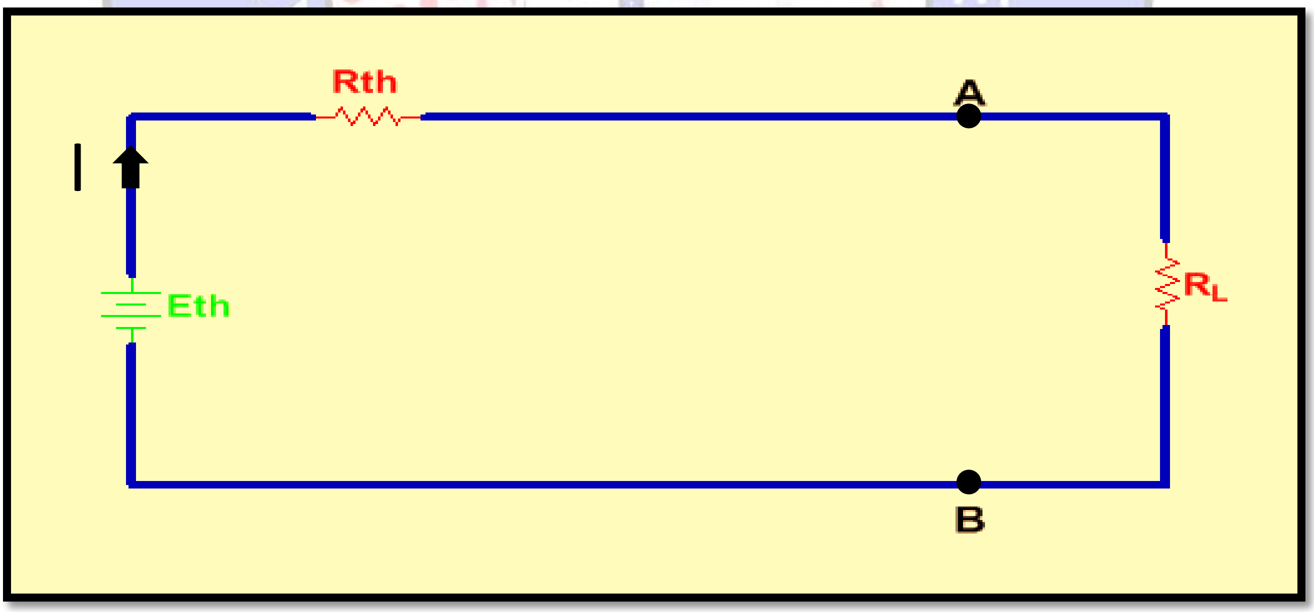

Fig.2 The equivalent Thevenin circuit with R_L

Procedure

1. Connect the circuit as shown in Fig.3

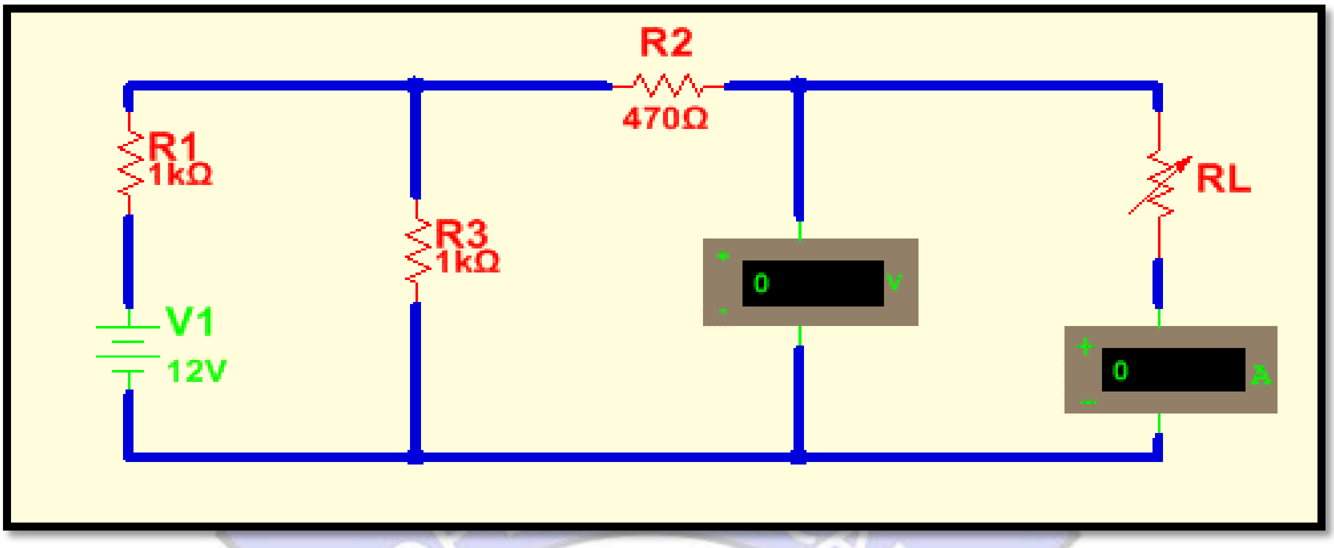

Fig.3

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).
3. Disconnect R_L, then measure the open loop voltage (E_{th}).
4. Calculate R_{th} theoretically and connect Thevenin equivalent circuit as shown in Figure (4).

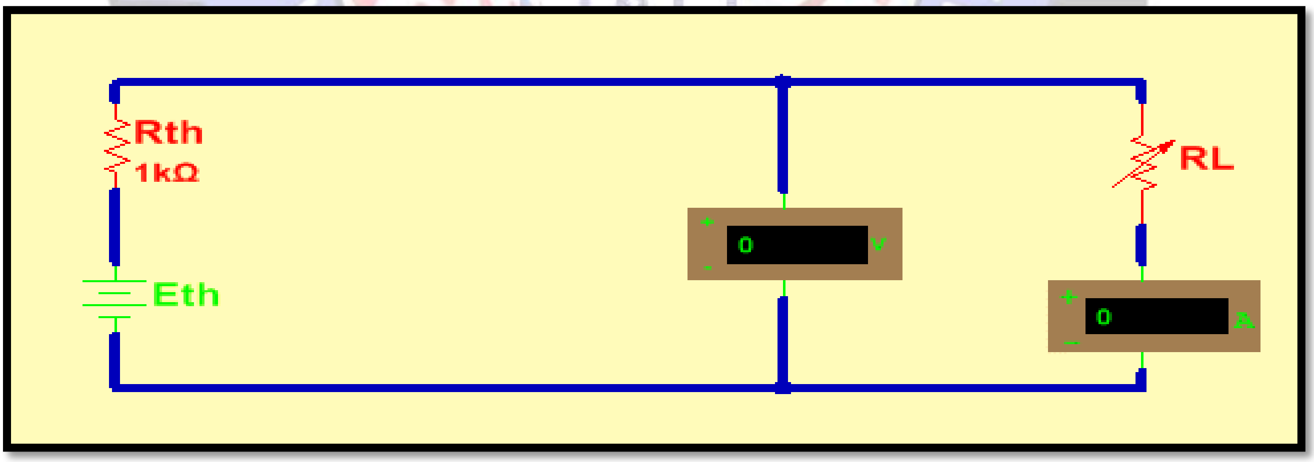

Fig.4

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

R_L	Fig.3	Fig.4

Ω	I_L(mA)	V_L(Volt)	I_L(mA)	V_L(Volt)
400				
500				
600				
700				
800				

Table.1 Practical Result

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 I_L and V_L theoretically from Fig.3 and Fig.4 then record your results in Table (2).
2. Compare briefly between the practical and theoretical results.
3. Using Thevenin's Theorem, determine the voltage across R_L, of the network shown in Fig.5

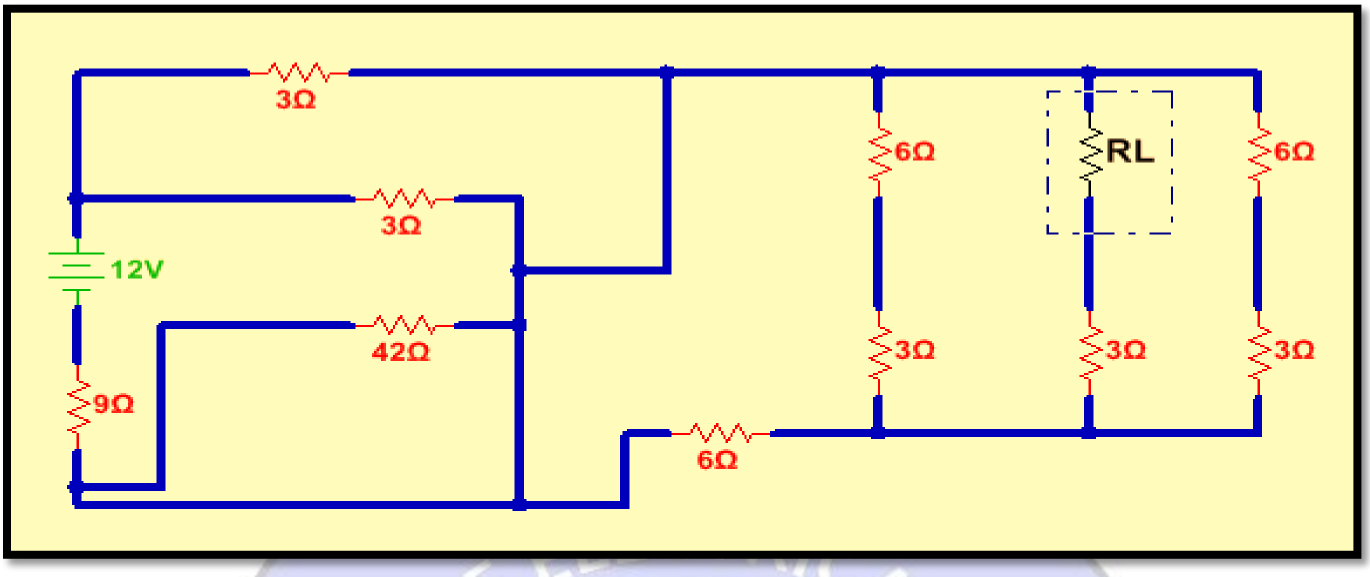

Fig.5