Verification of Maximum Power Transfer Theorem

6.1 Purpose/Objective:

The aim of this experiment is-

- To be familiar with the Maximum Power Transfer theorem and also to verify it.
- To know about its applicability.

6.2 Theory:

- Maximum power transfer theorem may be stated as follows:
  - A resistive load will receive maximum power from a network when the load resistance is equal to the Thevenin resistance of the network applied to the load. That is, when

$$R_L = R_{Th}$$

  - But, if the load resistance is lower or higher in value than the Thevenin resistance of the network, its dissipated power will be less than the maximum.
- Let us consider the Thevenin's equivalent circuit given below where R_2 is designated as the "load" resistor. We apply Maximum Power Transfer Theorem on this circuit:

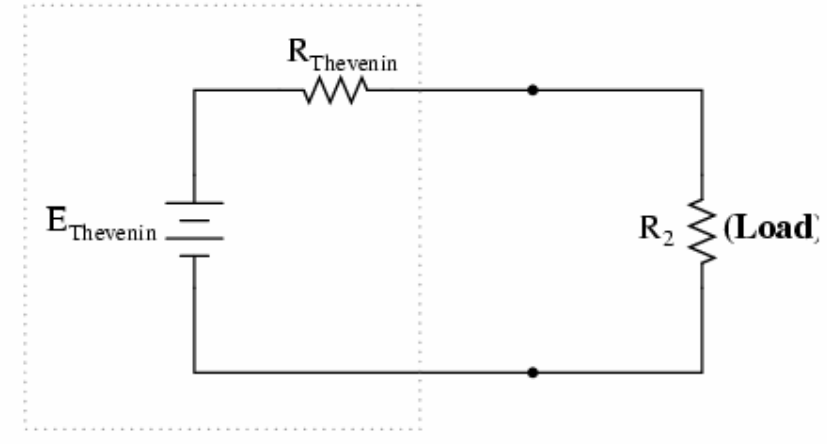

Figure-1: Thevenin equivalent Circuit

6.3 Equipment/ Apparatus:

a) One regulated variable Power Supply (0-30 V)

b) Ammeter and voltmeter

c) Circuit Experiment Board (Breadboard)

d) Fixed and variable resistors

e) Connecting wires

f) Cutting tools etc.

6.4 Cautions:

1. All connections should be tight and correct.
2. Switch off the supply when not in use.
3. Reading should be taken carefully.

6.5 Circuit Diagram:

The following Thevenin's equivalent circuit is chosen to verify Maximum Power Transfer theorem.

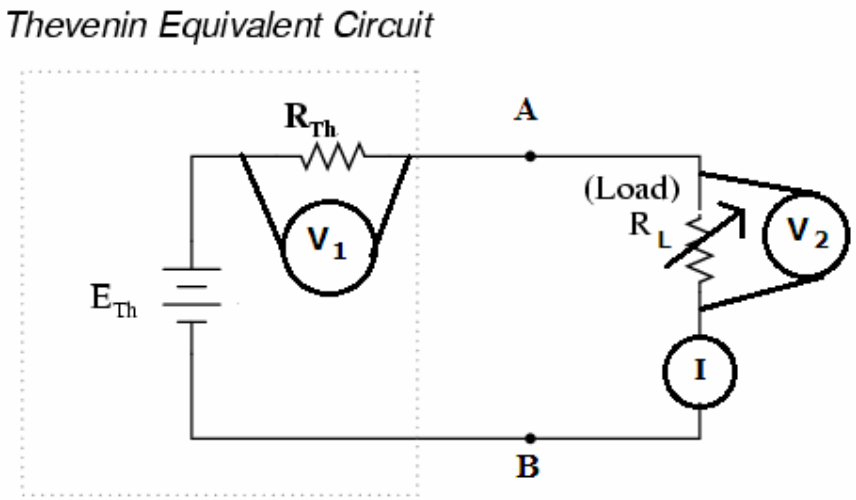

Figure-2: Thevenin's equivalent of a circuit with variable load resistor

6.6 Procedure:

1. Set up the circuit on the breadboard, as shown in figure-2.
2. Now set the load resistor R_L to a minimum (i.e. 0 Ω). Find voltage V_1 and V_2 across R_{TH} and R_L. Take the ammeter reading I. Now calculate $P_{TH}=V_1 xI$ and $P_L=V_2 xI$. Also calculate $R_L=V_2/I$.
3. Repeat step 2 for different values of R_L (almost double of R_{TH}).
4. Draw a graph of P_L versus R_L.

6.7 Data Table:

Note down the value of V_{TH} and R_{TH}. Fill up the following table and discuss on the experimental results.

Reading No.	V_1 **(Volt)**	V_2 **(Volt)**	I **(mA)**	P_L **(Watt**	R_L **(Ohm)**	P_1 **(Watt)**	$P_{TH}=P_1+P_L$ **(Watt)**
1.							
2.							
3.							
4.							
5.							

6.8 Result:

Maximum Power Transfer Theorem has been verified.

6.9 Drawing P_L Vs R_L Graph:

- Using the data from the table above, we can plot a graph of load resistance, RL on the x-axis against power, PL on the y-axis for different values of load resistance.

Lab Work: Experiment-5: Verification of Maximum Power Transfer Theorem

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- The PL-RL graph of maximum power transfer theorem should look like this:

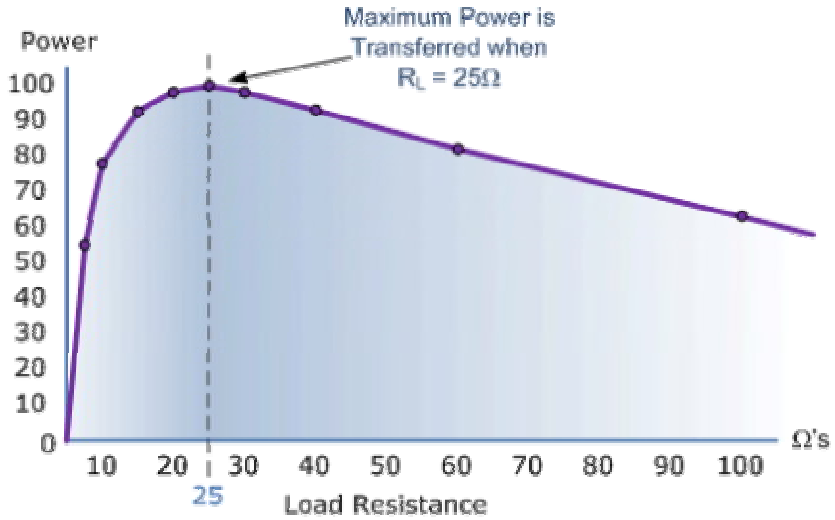

Figure-3: Graph of Power against Load Resistance

- From the above graph we can see that the **Maximum Power Transfer** occurs in the load when the load resistance, R_L is equal in value to the Thevenin's equivalent resistance, R_{Th}, so then:

Lab Work: Experiment-5: Verification of Maximum Power Transfer Theorem

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