INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

Department of Electronics & Electrical Engineering

EE102: Basic Electronics Laboratory

Expt.No.2: Verification of Circuit Theorems

Objectives:

1. To verify the Superposition Theorem, the Thevenin's Theorem and the Maximum Power Transfer Theorem

Materials Required:

1. Equipment: Breadboard, Multi-Output DC Power Supply, Oscilloscope
2. Components: 10Ω (1), 560Ω (1), 1kΩ (3), 2.2kΩ (3), 3.9kΩ (1), 4.7kΩ (1)

Precautions and Guidelines:

1. Make sure the ground terminals of the oscilloscope probes and power supplies are connected together in the circuit.
2. While switching on the set-up, switch on the oscilloscope first, followed by the power supply.

Pre-Lab Work:

1. For the circuit shown in Fig. 1, find the voltage V_C across resistance R where V_1 = 10V, V_2 = 5V (and zero source resistances).
2. Calculate the Thevenin's voltage and resistance as seen into terminals A-B of the circuit given in Fig. 2. Find the value of the maximum power that can be delivered to the load R_L.

Part A: Superposition Theorem

1. Assemble the circuit shown in Fig. 1. Use 0-32V and 5V sources of the multi-output DC power supply for realizing voltage sources V_1 and V_2 in the circuit. For the safety of resistors, do not apply more than 20V from 0-32V source.
2. To verify the superposition theorem for the voltage V_C across the resistance R, take the measurements as appropriate and fill Table 1. Verify that voltage V_C for Case-I is the sum of voltages obtained in Case-II and Case-III.

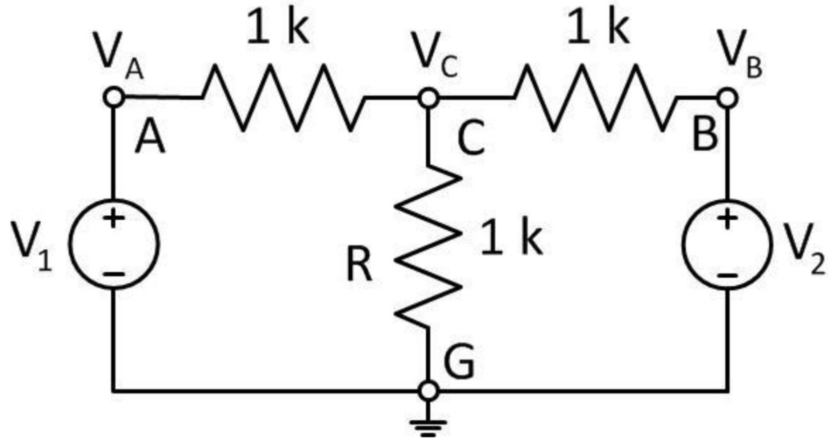

Fig. 1

	V_1 (Volt)	V_2 (Volt)	V_A (Volt)	V_B (Volt)	V_C (Volt)
Case-I	10	5			
Case-II	10	0			
Case-III	0	5			

Table 1

Part B: Thevinin's Theorem

1. Assemble the circuit as shown in Fig. 2. Remove load R_L and measure the open circuit voltage across terminals A-B (V_{OC}) with help of the oscilloscope.
2. Connect a small resistance of 10Ω across terminals A-B and measure the voltage drop $V_{10\Omega}$.
3. Calculate the values the values of V_{Th} and R_{Th} and fill Table 2.

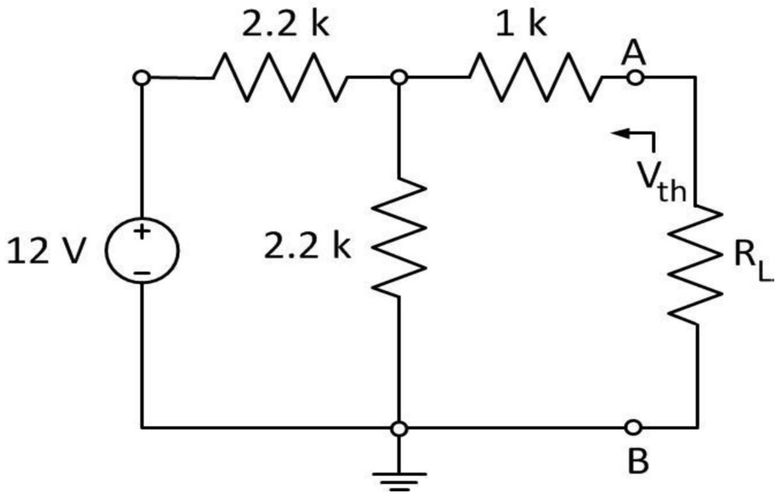

Fig. 2

V_{OC} (Volt)	$V_{10\Omega}$ (Volt)	V_{Th} (Volt)	R_{Th} (Ω)

Table 2

Part C: Maximum Power Transfer Theorem

1. Modify the circuit with a small resistance of 10Ω connected in series with the load R_L between terminals A-B as shown in Fig. 3. The voltage drop across terminals C-B (Channel 2) is to be used to infer the current through the load (I_L). The voltage drop across terminals A-B (Channel 1) is to be approximated for the voltage drop across the load R_L.
2. Make measurements by varying the value of the load resister R_L as in Table 3. Calculate the power consumed by the load in each case.

R_L (Ω)	V_A (Volt)	V_C (Volt)	I_L (A)	Power (Watt)
560				
1000				
2200				
3900				
4700				

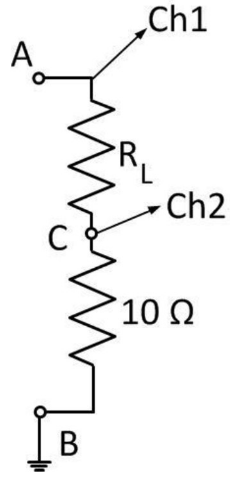

Fig. 3

Part D: Lab Report

Prepare and submit a lab report as specified in the general instructions regarding the lab. Include the answers to the following questions in the report:

1. How accurate is the verification of superposition theorem in Part A? Why?
2. Is there a difference between the theoretical values of V_{Th} and R_{Th} and the measured value? Why?
3. Compare the measured values of power consumed by each load as in Part C and the theoretical maximum for power transfer and explain.