EEL101: Basic Electrical Lab

Experiment No: 3 Date:

Batch No.		**Team Number**	
	Team Member 1	**Team Member 2**	**Team Member 3**
Name			
ID No			

Aim: Experimental verification of Thevenin's theorem in DC circuits and AC circuits.

Apparatus Required:

S.No.	Instrument	Range	Quantity
1.	Bread board		1
2.	Resistors	270-ohm, 220-ohm, 150-ohm, 82 ohm	As per circuit diagram
3.	Digital multimeter, Ammeter	(0-30 mA)	1
4.	Jumper wires		As per need
5.	DC power, RPS (Regulated Power Supply)	(0-30V)	2

R1 = 270 ohm R2 = 220 ohm R3 = 150 ohm Rl = 82 ohm

Theory:

Thevenin's Theorem: -

Thevenin's Theorem is a fundamental concept in electrical circuit analysis that simplifies complex linear circuits into an equivalent circuit comprising a single voltage source and a single resistor. This theorem is particularly useful for analyzing and solving electrical circuits, making it an essential tool for engineers. The theorem is named after the French engineer Léon Charles Thevenin.

The statement of Thevenin's Theorem is as follows for resistive networks: "Any linear electrical network with voltage and current sources and resistances can be replaced by an equivalent circuit containing a single voltage source (Thevenin voltage) in series with a single resistor (Thevenin resistance)."

Key Components of Thevenin's Theorem:

Thevenin Voltage (V_{th}): The voltage across the terminals of the original circuit when all the resistances within the circuit are removed, leaving only the independent voltage and current sources.

Thevenin Resistance (R_{th}): The equivalent resistance of the original circuit as seen from the terminals when all independent sources are turned off (replaced by their internal resistances if applicable).

Circuit Diagram and Procedure:

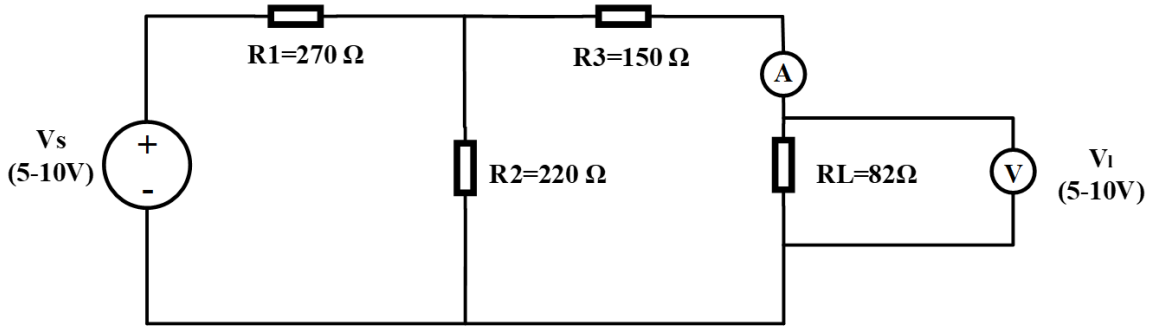

Fig1: A resistive circuit with DC voltage source and load resistance.

Take R_1 = 270Ω, R_2 = 220Ω, R_3 = 150Ω , RL=82 Ω

1. Connect the circuit as per Fig. 1 in the bread board and apply the voltage as per the range given.
2. Measure the voltage across the load using a digital multimeter by connecting the patch cords across the load resistance.

Thevenin's Equivalent Voltage:

1. Remove the load resistance and connect the circuit as per Fig. 2.
2. Measure the voltage across the load terminals using a digital multimeter by connecting the patch cords across the load terminal.

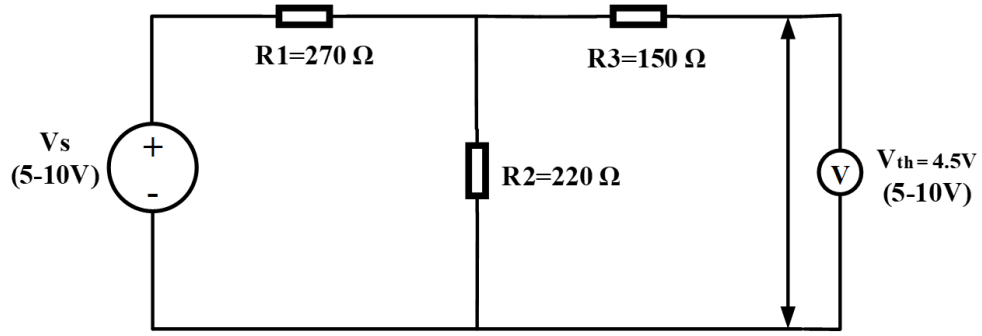

Fig2: Measurement of voltage across the circuit from load terminals.

Thevenin's Equivalent Resistance:

1. Replace the voltage source by its internal resistance and remove the load resistance from the load terminals.
2. Connect the circuit as per Fig. 3.
3. Using a digital multimeter in resistance mode, measure the resistance across the load terminal.

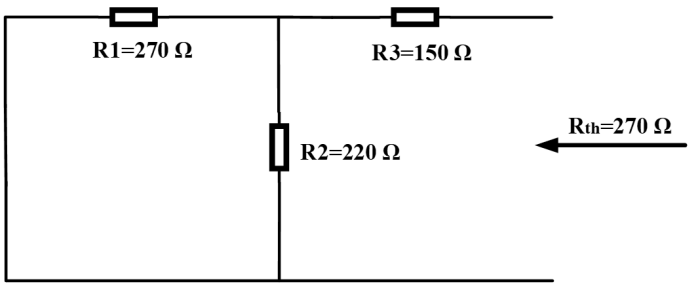

Fig3: Measurement of voltage across the circuit from load terminals.

Thevenin's Circuit:

1. Connect the supply V_{th} and resistance R_{th} in series as shown in the circuit diagram of Fig. 4.
2. Connect the load resistance.
3. Switch on the dc voltage supply and measure the voltage across the load resistance using a digital multimeter.

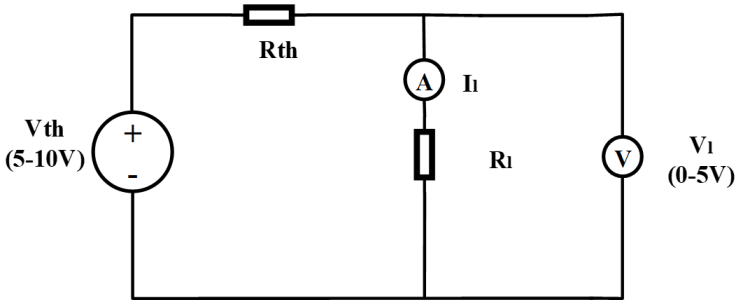

Fig4: Measurement of voltage across the circuit from load terminals.

Observation Tables:

S.No.	RPS (Vs) Volts (DC)	Load Voltage (V_l) Volts(DC)	Load current (I_l) mAmps(DC)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Calculation of Thevenin's Voltage

S.No.	RPS (Vs) Volts (DC)	Thevenin's Voltage (V_{th}) Volts (DC)
1.		
2.		
3.		
4.		

5.		
6.		
7.		
8.		
9.		
10.		

Calculation of Thevenin's Resistance

S.No.	Thevenin's Resistance (R_{th}) Ohms
1.	

Calculation of Load voltage and current in Thevenin's equivalent circuit:

S.No.	Thevenin's Voltage (V_{th}) Volts (DC)	Thevenin's Resistance (R_{th}) Ohms	Load Voltage (V_l) Volts (DC)	Load current (I_l) mAmps (DC)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Calculations: Show in the attached A4 sheets (One set of calculations to be submitted by each team. However, each member of the team should practice doing such calculations)

Conclusions (Learning Outcomes): Show in the attached A4 sheets (Each member of the team should mention at least one point here).

Precautions:

1. Voltage control knob of RPS should be kept at the minimum position.
2. Current control knob of RPS should be kept at the maximum position.

Sample Post-Lab Questions

1. Can Thevenin's Theorem be applied to a non-linear circuit?
2. What are the theoretical limitations of Thevenin's Theorem?
3. What are the steps to follow Thevenin's Theorem?

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Following empty space is provided for each team to show their calculations, conclusions, and their answers to sample post-lab questions.

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