Course Name:	**Elements of Electrical and Electronics Engineering Laboratory**	**Semester:**	**I/II**
Date of Performance:	**13/09/2024**	**Batch No:**	**C5-3**
Student Name:	**Rajat Kumar**	**Roll No:**	**54**
Faculty Sign & Date:		**Grade/Marks:**	**/ 20**

Experiment No: 3

Title: Thevenin's Theorem & Norton's Theorem

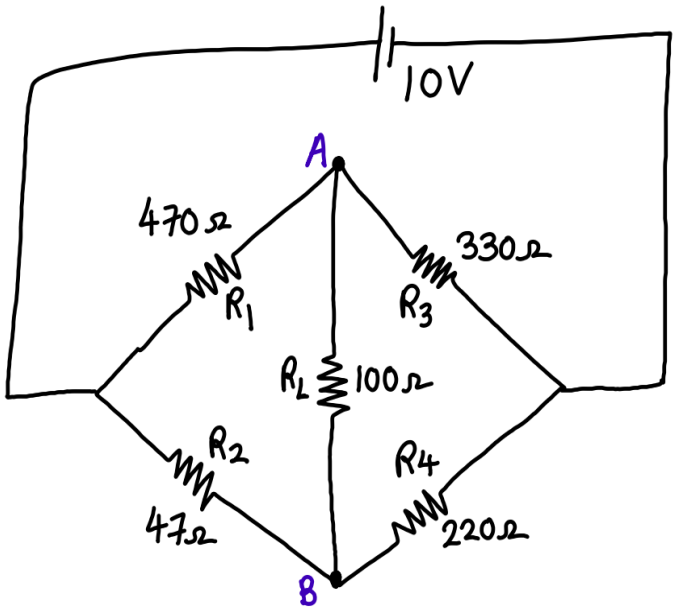
Aim and Objective of the Experiment:

- To Verify for Thevenin's Theorem for the circuit
- To Verify Norton Theorem for the Circuit.

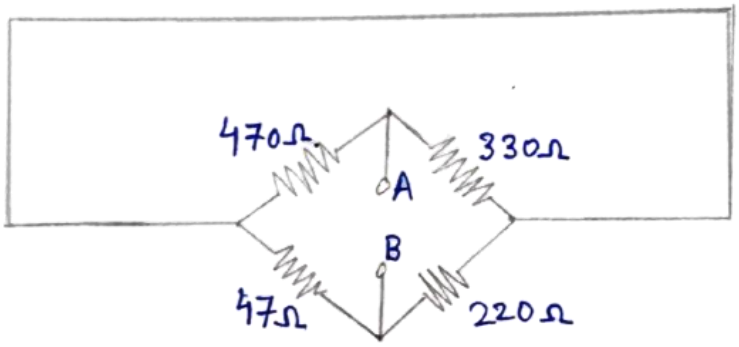
COs to be achieved:

CO1: Analyze resistive networks excited by DC sources using various network theorems.

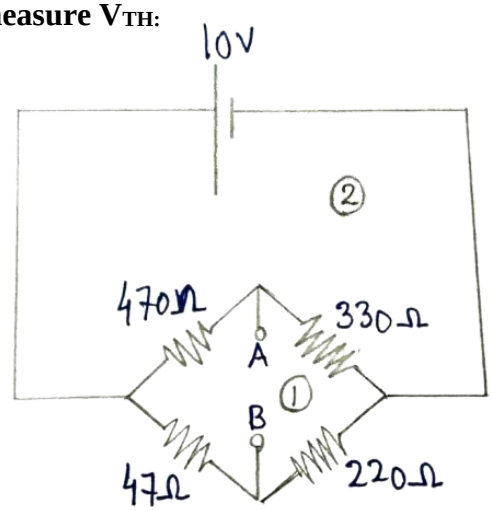
Circuit Diagram:



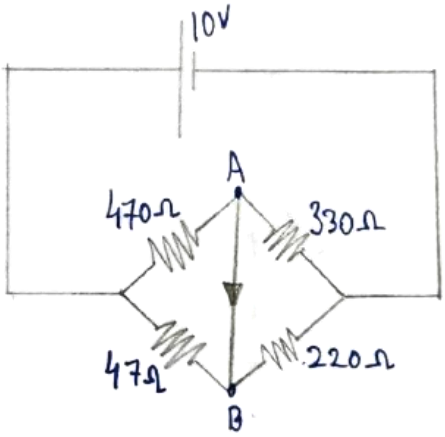
Task 1: Circuit Diagram to measure R_{TH}/R_N:



Task 2: Circuit Diagram to measure V_{TH}:



Task 3: Circuit Diagram to measure I_{SC}:



Stepwise-Procedure:

Thevenin's Theorem:

1. Connect the circuit as shown in the circuit diagram.
2. Set 10V and measure open circuit voltage V_{Th} across load terminals A and B.
3. Replace all voltage sources by Short circuit and measure R_{Th} across terminals A and B as per the circuit diagram shown in the figure.
4. Draw Thevenin's equivalent circuit and determine the value of load current from it.
5. Verify the results theoretically.

Norton's Theorem:

1. Connect the circuit as shown in the circuit diagram.
2. Set the voltages 10V
3. Remove the load resistance and measure the short circuit current I_{SC} through A and B terminals.
4. Replace all the voltage sources by Short circuit and measure R_{Th} across terminals A and B as per the circuit diagram shown in the figure.
5. Draw Norton's equivalent circuit and determine the value of load current.
6. Verify the results theoretically

Calculations:

1. To Calculate R_{Th}/R_N :

→ $R_1 \parallel R_3$

$\therefore 470 \parallel 330 = \frac{470 \times 330}{800}$

$= 193.87\ \Omega \ldots (1)$

→ $R_2 \parallel R_4$

$\therefore 47 \parallel 220 = \frac{47 \times 220}{267}$

$= 38.72\ \Omega \ldots (2)$

→ Since, (1) & (2) ; both are in series –

$\therefore (1) + (2) \Rightarrow \boxed{R_{th} = 232.6\ \Omega}$

2. To Calculate V_{Th} :

$V_{AB} = 470(I_1 - I_2) + 47 I_1 = 517 I_1 - 470 I_2 \ldots (3)$

Loop across mesh (1)

$\Rightarrow -470(I_1 - I_2) - 330(I_1 - I_2) - 220 I_1 - 47 I_1 = 0$

$\therefore -1067 I_1 + 800 I_2 = 0 \ldots (4)$

Now, Loop across mesh (2)

$\Rightarrow -330(I_2 - I_1) - 470(I_2 - I_1) = 10$

$\therefore 800 I_1 - 800 I_2 = 10 \ldots (5)$

From (4) & (5) $I_1 = -0.0375$, $I_2 = -0.05$

$\because V_{AB} = 517(-0.0375) - 470(-0.05)$

$= -19.39 + 23.5$

$= 4.11\ V$

$\therefore V_{AB} = V_{th}$ $\therefore \boxed{V_{th} = 4.11\ V}$

3. To Calculate I_N/I_{SC} :

$I_{sc} = I_N = \frac{V_{th}}{R_{th}}$

$\because R_{th} = R_N \Rightarrow \therefore I_{sc} = \frac{V_{th}}{R_N} = \frac{4.11}{232.6} = 17.66\,mA$

$\therefore \boxed{I_{sc} = 17.66\,mA}$

4. To Calculate I_L :

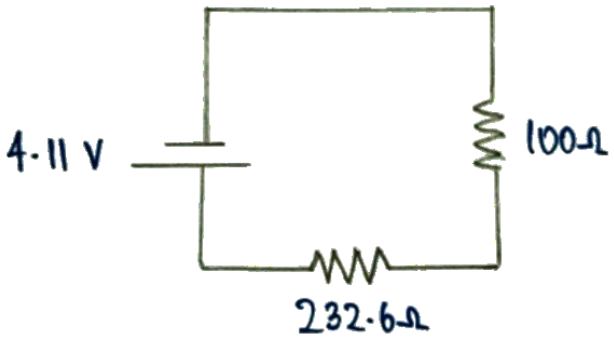
$I_L = \frac{V_{th}}{R_{th}+R_L} = \frac{R_N \times I_{sc}}{R_{th}+R_L} = \frac{4.11}{332.6}$

$\therefore \boxed{I_L = 12.35\,mA}$

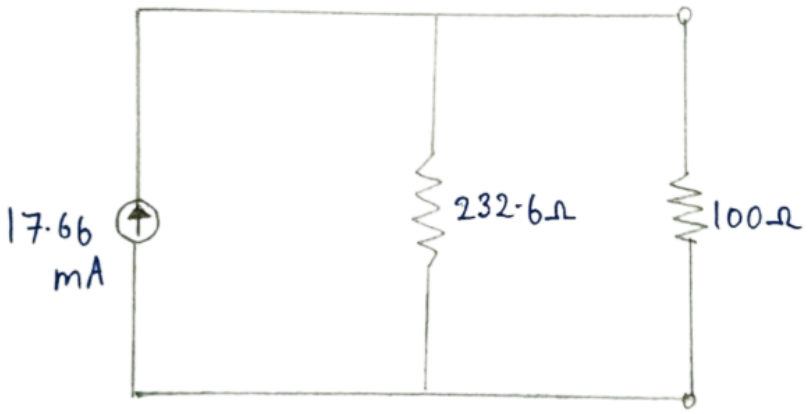
Observation Table:

	V_{TH} (V)	R_{TH} / R_N (Ω)	I_N (mA)	I_L (mA)
Theoretical value	**4.11V**	**232.6 Ω**	**17.66 mA**	**12.35 mA**
Practical value	**4.12V**	**231.8 Ω**	**17.54 mA**	**12.41 mA**

Draw Thevenin's Equivalent circuit



Draw Norton's Equivalent circuit



Conclusion:

By performing the experiment, we can verify that Thevenin's and Norton's theorems provide methods for simplifying complex circuits and reducing them to their equivalent forms, facilitating easier analysis and confirming the theorems' accuracy in practical applications.

Signature of faculty in-charge with Date: