GARVIT SHAH
F-24

EXPERIMENT : No. 04

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Date

- **Aim:** To verify Thevenin's theorem for electric circuit.

- **Apparatus:** DC Power supply, Ammeter (0-1A), Voltmeter (0-150V), Rheostats, Multimeter.

- **Theory:**

Thevenin's theorem says that, "Any two terminal, linear bilateral network ~~saying~~ ~~it~~ having no. of voltage sources, current sources & resistances can be replaced by a simple equivalent circuit consisting of a single voltage source in series with a resistance, where the value of the voltage source is equal to the open circuit voltage source is equal to the open circuit voltage across the two terminals of the network, and the resistance is the equivalent resistance measured between the terminals with cell energy sources replaced by their internal resistances.

- **Procedure:**

1. Connect the circuit as shown in Fig. I
2. Measure the current through the load resistor (I_L) using ammeter & note it down.
3. Remove the load resistor & calculate the open

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Teacher's Sign. : _____

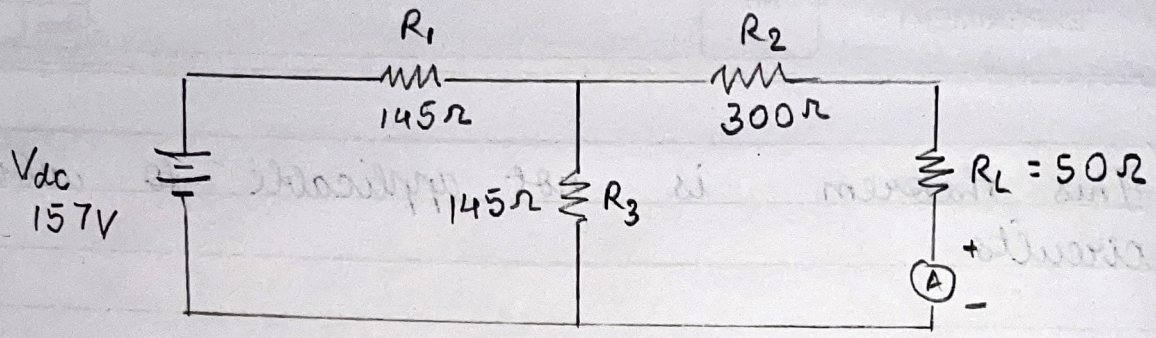

Fig 1 - Basic Circuit

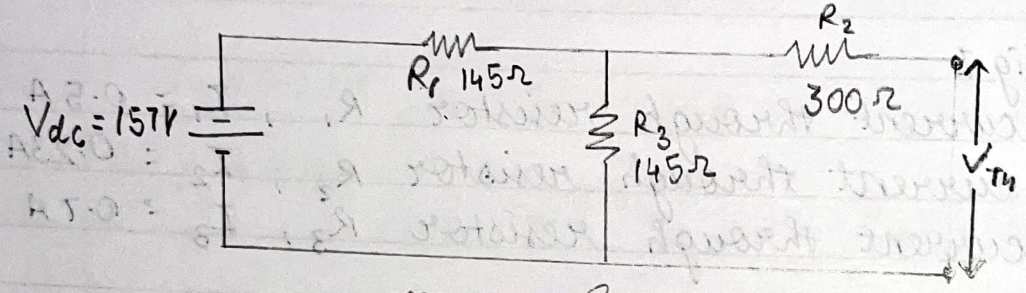

Fig 2 - Calculation of V_{Th}

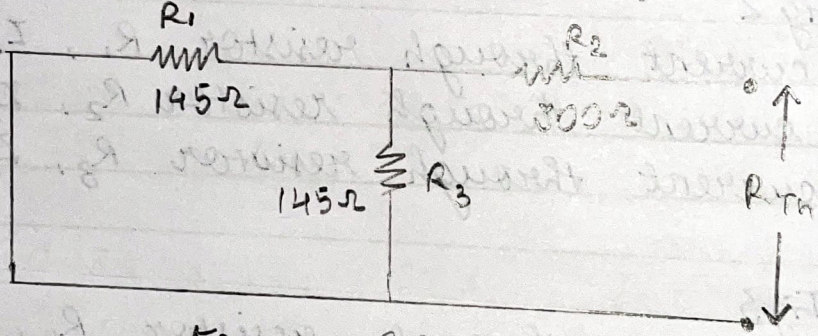

Fig 3 - Calculation of R_{Th}

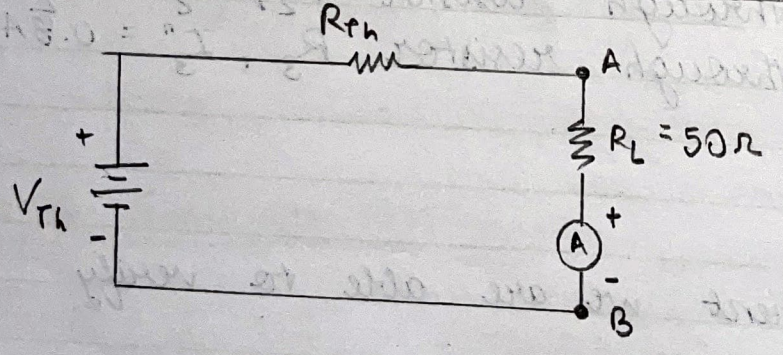

Fig 4 - Thevenin's Equivalent Circuit

circuit voltage (V_{Th}) across the terminals A & B which is equal to the voltage across 50Ω resistor as shown in Fig 2.

4. Short circuit the voltage source & calculate thevenin's equivalent resistance (R_{Th}) across the terminals A & B as shown in Fig 3.

5. Connect the circuit as shown in Fig 4 i.e. Thevenin's equivalent circuit and calculate the current through load resistor by using ammeter & note it down.

- **Questions –**

1. Calculate the current through load resistor using thevenin's theorem for circuit shown in Fig. 1 for following values of load resistor :
(a) $R_{L_1} = 75\Omega$ (b) $R_{L_2} = 100\Omega$

A.1 We already know $R_{Th} = 372.52\Omega$ & $V_{Th} = 78.5\,V$

(a) ∴ Current through load resistor = $\frac{V_{Th}}{R_{Th} + R_{L_1}}$

$$\Rightarrow \frac{78.5}{372.5 + 75} = \underline{\underline{0.175\,A}}$$

(b) ∴ Current through load resistor = $\frac{V_{Th}}{R_{Th} + R_{L_2}}$

$$\Rightarrow \frac{78.5}{372.5 + 100} = \underline{\underline{0.166\,A}}$$

Observation :

Parameters	Observed Values	Calculated Values
Load Current I_L	0.2A	0.186A
Thevenin's Eq. Resistance, R_{Th}	400 Ω	372.5 Ω
Thevenin's Eq Voltage, V_{Th}	78V	78.5V
Load current using Thevenin's Theorem, I_L	0.18A	0.186A

Calculations :

Fig 1 : $R_{eq} = 145 + \frac{(145)(300+50)}{145+300+50}$ $\quad R_{eq} = 247.52\,\Omega$

Total Current $= \frac{V_{dc}}{R_{eq}} = \frac{157}{247.52} = 0.634\,A \quad (I)$

Load Current $I_L = I \times \frac{145}{495} = 0.634 \times \frac{145}{495}$

$I_L = 0.186\,A$

For V_{Th} : $V_R = V_{dc} \cdot \frac{R_3}{R_1+R_3} = 157 \times \frac{145}{290}$ $\quad \boxed{V_{Th} = 78.5V}$

For R_{Th} : $R_{Th} = 300 + \frac{145 \times 145}{290} = 372.52\,\Omega$ $\quad \therefore I_L' = \frac{V_{Th}}{R_L+R_{Th}} = 0.186\,A$

- **Results :**

OBSERVED -

- Load current I_L is 0.2A
- Thevenin's equivalent voltage V_{Th} is 78V.
- Thevenin's equivalent resistance R_{Th} is 400Ω.
- Load current using Thevenin's Theorem I_L is 0.18A.

CALCULATED -

- Load current I_L is 0.186A
- Thevenin's equivalent voltage V_{Th} is 78.5V
- Thevenin's equivalent resistance R_{Th} is 372.5Ω
- Load current using Thevenin's theorem I_L' is 0.186A

- **Conclusions :**

Thevenin's Theorem was successfully verified within bounds of experimental errors and can be used for ~~simplicity~~ simplifying circuits which are linear & bilateral in nature.