DATE:

VERIFICATION OF NORTON'S THEOREM

EXP - 05

AIM:

To verify Norton's theorem practically and theoretically for the given DC circuit.

APPARATUS REQUIRED:

S NO	APPARATUS	SPECIFICATION	QUANTITY
1	Regulated power supply	(0-30) V	1
2	Voltmeter	(0-30) V	1
3	Ammeter	(0-10mA) MC	1
4	Resistor	470Ω, 560Ω, 1KΩ	2, 1, 1
5.	Bread board	-	1
6.	Multimeter	-	1

PROCEDURE:

1. Make the connections as per the circuit diagram 1.

2. Vary the RPS and set an input voltage of 10V

3. Note down the voltmeter reading (V_i) and ammeter reading (I_i) in the tabular column 1.

4. Switch off the supply and make connections for the circuit diagram

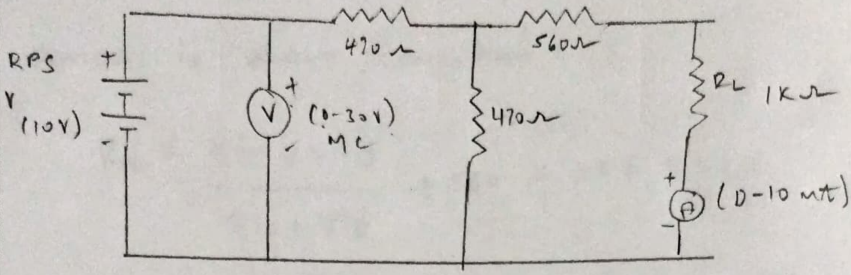
5. Measure the thevenin's resistance

R_{Th} = Norton's Resistance R_N

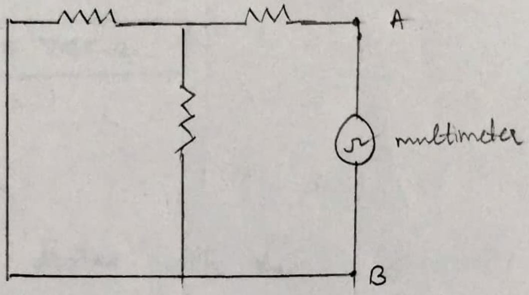
6. Switch off the supply of 10V in the RPS and note down the voltmeter reading V_i and V_{Th}

CIRCUIT DIAGRAM: VERIFICATION OF NORTON's THEOREM:

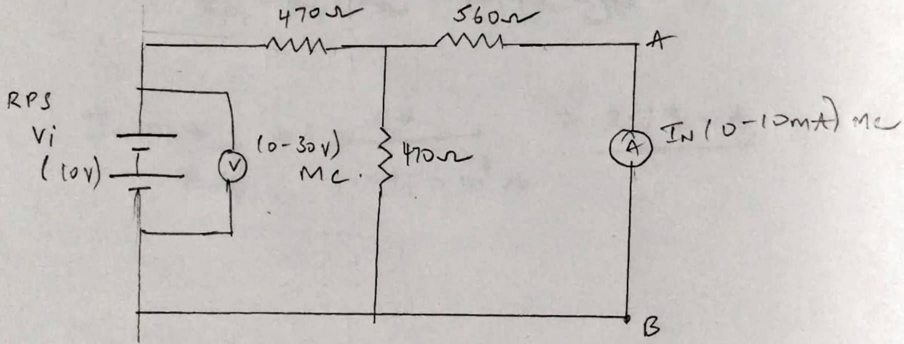
To measure I_L:



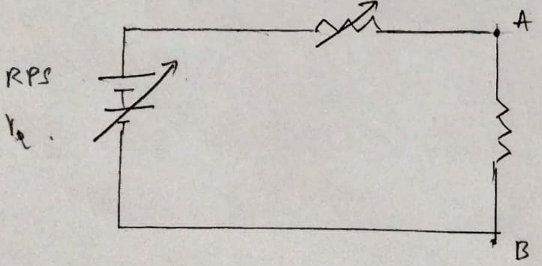
To measure R_{th} or R_N



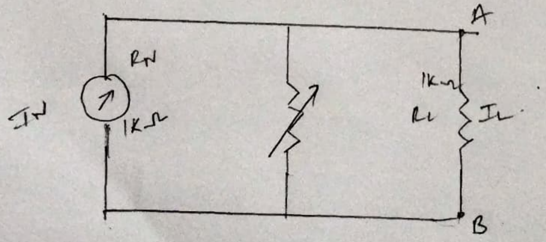
To measure I_N or I_{sc}:



Thevenin's equivalent criteria:



Norton's equivalent criteria:



Tabular column:

To measure I_L:

V_i (volt)	I_L (amps)
10	2.86 A

in tabular column. 3.

7. Set an input voltage of 10V in the RPS and note down the voltmeter reading Vi and $V_{Th} = V_{oc}$.

8. Switch off the supply and make connections for the circuit diagram 4.

9. Set an input voltage of 10V in the RPS and note down the voltmeter Vi and the ammeter reading I_N (sc) in tabular column 4.

10. Draw the thevenin's equivalent circuit and norton's equivalent circuit as shown in a circuit diagrams 5 and 6 respectively.

11. Calculate the I_L value using the formula

Thevenin's theorem

$$I_L = \frac{V_{Th}}{R_{Th} + R_L}$$

Norton's Theorem

$$I_L = \frac{I_N * R_N}{R_N + R_L}$$

12. Theoretically verify the Norton's theorem

RESULT:

Thus Thevenin's and Norton's theorem is verified practically and theoretically.

TABULAR COLUMN 2:

To measure R_{th} or R_N.

vi (volt)	R_{th} (Ω)
10 V	773 Ω

TABULAR COLUMN 3:

To measure I_N or I_{sc}.

Vi (volt)	I_N (milliamp)
10	6.38 mA

MODEL CALCULATION:

Practical value of I_2 (from tabulation 1) $= 2.3$ mA

verification of Norton's theorem

$$I_L = \frac{I_N * R_N}{R_N + R_L} = 2.43 \text{ mA}$$

Theoretical calculation of I_L, I_N and R_{th} (R_N) for the given circuit.

THEORETICAL CALCULATION:

Parallel R_3 and R_2 after short circuit, R_L.

$$R_{par} = \frac{560 \times 420}{560 + 470} = 255.53 \Omega$$

at node A,

$$V_A = \frac{10V \times R_{par}}{R_1 + R_{par}} = \frac{10 \times 255.53}{470 + 255.53}$$

$$\boxed{V_A = 3.52 V.}$$

current through 560 Ω,

$$I_{sc} = \frac{V_A}{560} = \frac{3.52}{560} = 6.285 \text{ mA}$$

$$R_N = \frac{470 \times 470}{470 + 470} + 560 = 795 \Omega \quad \boxed{\therefore R_N = 795 \Omega}$$

$$\therefore I_L = I_N \times \frac{R_N}{R_N + R_L} = 6.28 \text{ mA} \times \frac{795}{795 + 1000}$$

$$\boxed{I_L = 2.79 \text{ mA}}$$