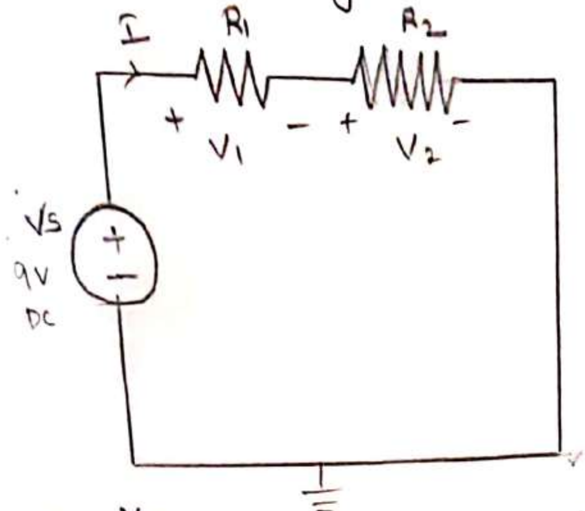
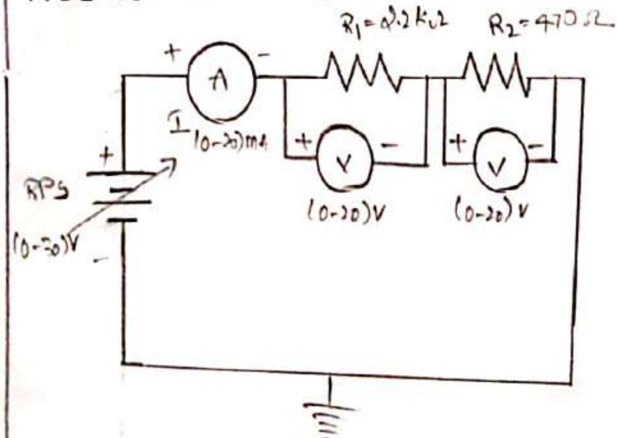
Model circuit diagram:-

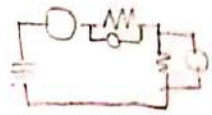


$$I = \frac{V_s}{R_1+R_2} \qquad V_1 = I R_1 \qquad V_2 = I R_2$$

$$V_1 = \frac{V_s}{R_1+R_2} \cdot R_1 \qquad V_2 = \frac{V_s}{R_1+R_2} \cdot R_2$$

Practical circuit Diagram





calculations of Theoretical values:-

Given $R_1 = 2.2\ K\Omega = 2200\ \Omega$ $\quad R_2 = 470 \quad V_s = 14V$

$$I = \frac{V_s}{R_1+R_2} = \frac{14}{2200+470}$$

$$\boxed{I = 5.24 \times 10^{-3}\ A}$$

$$V_1 = \frac{V_s R_1}{R_1+R_2} = \frac{14 \times 2200}{2200+470}$$

$$\boxed{V_1 = 11.53V}$$

$$V_2 = \frac{V_s R_2}{R_1+R_2} = \frac{14 \times 470}{2200+470}$$

$$\boxed{V_2 = 2.46V}$$

$$V = V_1 + V_2 = 11.53 + 2.46$$

$$\boxed{V = 13.99\ V}$$

Experiment :- 1 - 1(a)

Date : 27-01-2020

Analysis of Series and Parallel circuits

[1A]

Prove voltage divider rule.

Aim : To analize the series circuit

Apparatus:

SNO	Name of the Apparatus	Range	Quantity
1	Ammeter	(0-20)mA	1
2	Voltmeter	(0-20)V	2
3	Breadboard		1
4	Resistors	2.2KΩ, 470Ω	2
5	connecting wires		As per requirement
6	RPS	(0-30)V	1
7	Patch chords		

Procedure

* Connect the circuit as shown in fig;
* Vary the RPS (voltage) and note the values of V_1, V_2 and current (I) as shown in tabular column
* Verify the theoretical and practical values

Precautions

* Loose connections shd be avoided
* Voltmeters shd be connected in "parallel" to resistor and ammeter shd be connected in "series"
* Parallax error Should be avoided

Tabular form:-

$V_s(V)$	$I(mA)$	V_1 (V)	V_2 (V)
1.3	0.5	1.1	0.2
1.9	0.7	1.6	0.3
2.5	1.0	2.1	0.4
34	1.3	2.8	0.6
4.6	1.7	3.8	0.8

comparison:-

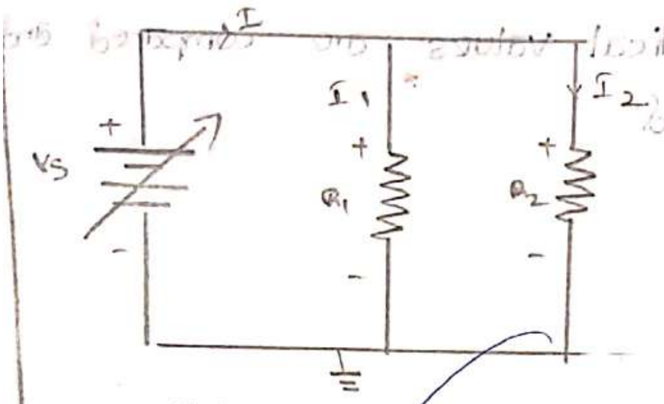
	Theoritical	Practical
$V_1(V)$	11.5	11.6
$V_2(V)$	2.46	2.4
$I(mA)$	5.27	5.1

Scanned with CamScanner

Result:-

Theoretical and practical values are compared and the circuit is analyzed

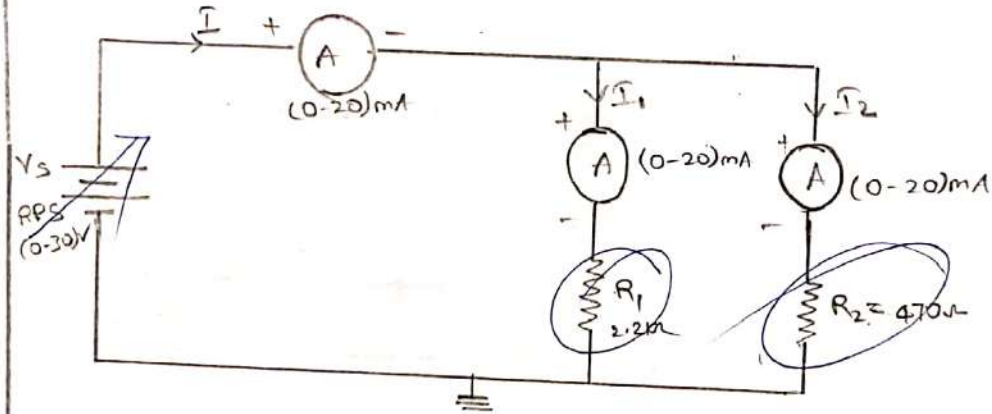
Model circuit diagram:-



$$V_S = \frac{I R_1 R_2}{R_1 + R_2} \qquad I_1 = \frac{V_S}{R_1} = \frac{I R_2}{R_1 + R_2} \qquad I_2 = \frac{V_S}{R_2} = \frac{I R_2}{R_1 + R_2}$$

$$I = \frac{V_S (R_1 + R_2)}{R_1 R_2}$$

Practical circuit diagram



Calculation

Theoritical valu

$V_S = 9V \quad R_1 = 2.2K\Omega = 2200 \quad R_2 = 470\Omega$

$$I = \frac{9\,(2670)}{(2200)(470)} \qquad \frac{V_S (R_1 + R_2)}{R_1 R_2}$$

$I = 23.2mA$

$$I_1 = \frac{I R_2}{R_1 + R_2}$$

$$= \frac{23.2(470)}{2670}$$

$I_1 = 4.09mA$

$$I_2 = \frac{23.2(2200)}{2670} \qquad \frac{I R_1}{R_1 + R_L}$$

$I_2 = 19.11mA$

Experiment NO. :- 1 Date: - 27-01-2020

Analysis of series and parallel circuit:

1(b)

Aim :- To analise the parallel circuits

Apparatus:

S.no	Name of apparatus	Range	Quantity
1	Ammeter	(0-20)mA	3
2	Resistor	2.2KΩ, 470Ω	2
3	Bread board		1
4	connecting wires		As per req
5	RPS	(0-30)V	1
6	Patch chords		As per req

Procedure:

* connect the circuit as shown in fig.
* Varry the RPS (voltage) and note down the values of I, I_1, I_2 as shown in tabular column.
* Verify the theoristical and practical values.

Precautions

* Loose connections should be avoided
* (voltmeter) Ammeters are connected series to the resistor.
* Parallax error should be avoided

Tabular Column:

V_S(V)	I(mA)	I_1(mA)	I_2(mA)
1.1	1.2	0.5	0.1
2.6	6.1	1.1	4.8
6.7	16.9	2.9	13.3
9	23.1	4	19.1
10.1	26.1	4.4	21

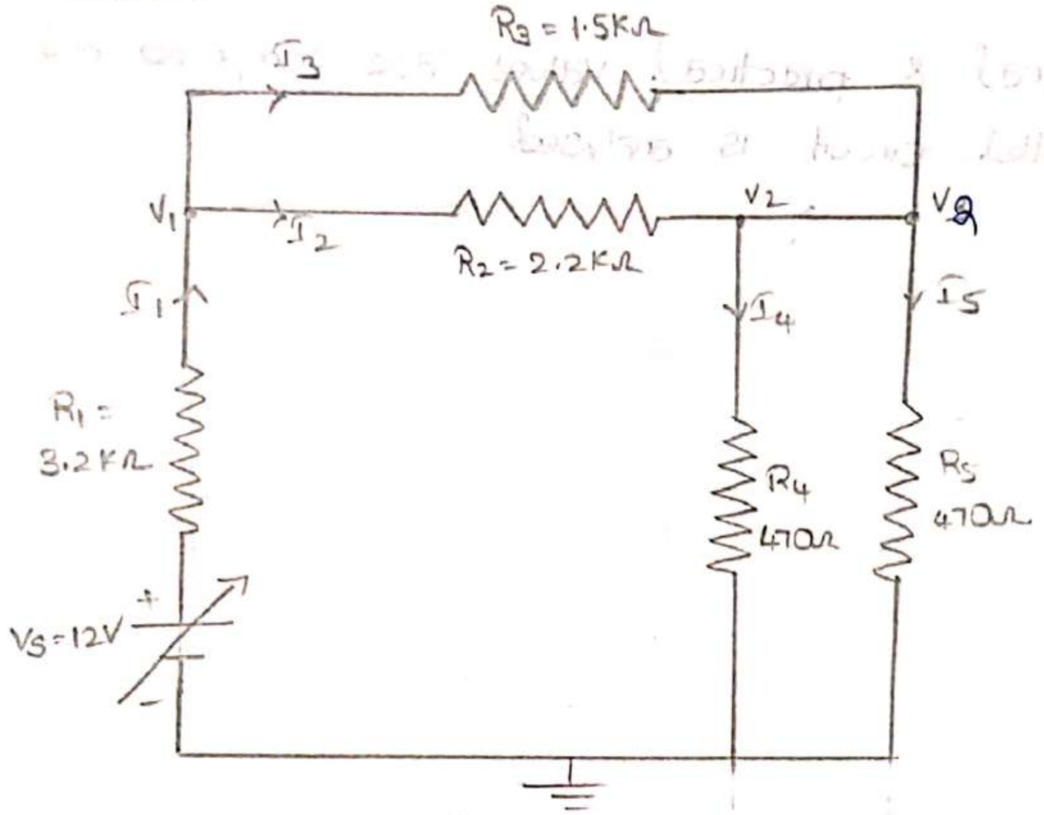
Comparison:

	Theoretical	Practical
I(mA)	23.2	23.1
I_1(mA)	4.09	4
I_2(mA)	19.11	19.1

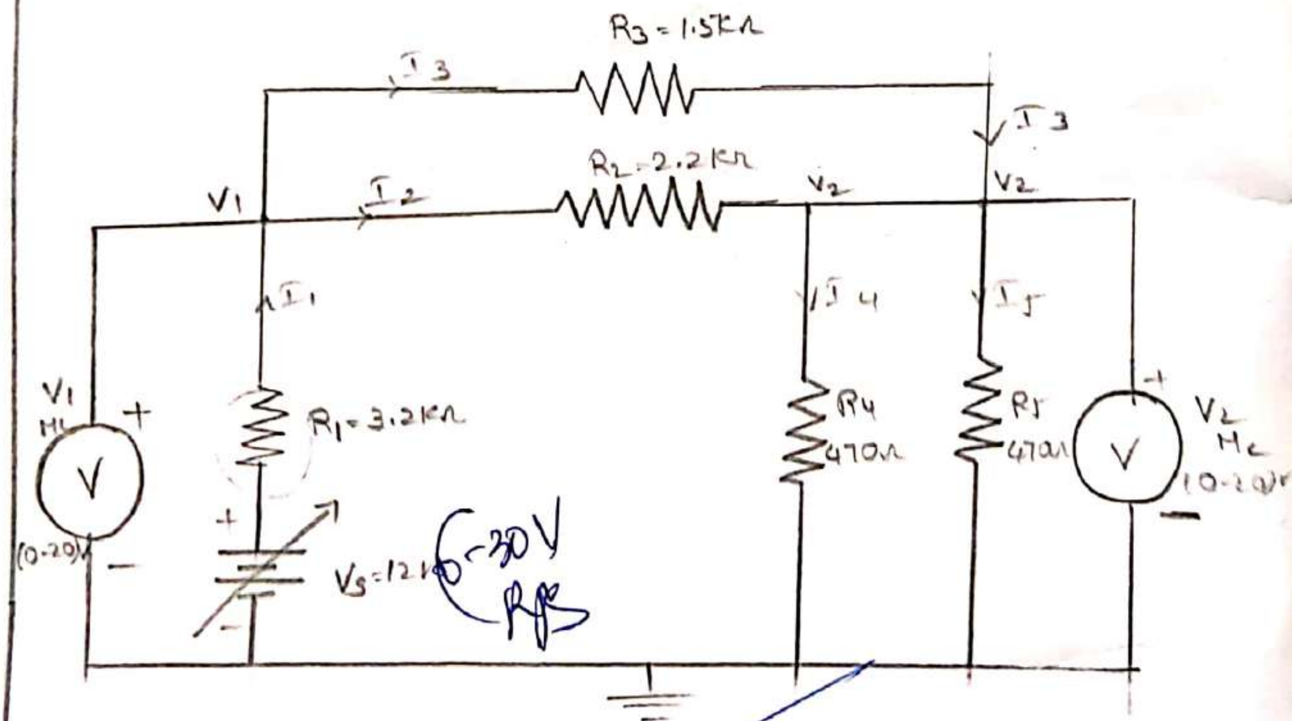
Result:

Theoritical & practical values are compared and the parallel circuit is analysed.

Theoritical



Practical



3/01/20

Experiment No :- 2
Nodal Analysis

Aim:- To analyze the nodal circuits with the given resistors by using Ammeter & voltmeter

Apparatus required:

S.NO	components	Type	Range	Quantity
1	RPS	variable	(0-30)	1
2	Bread board	—	—	1
3	Resistor	—	3.2KΩ, 2.2KΩ, 1.5KΩ, 470Ω, 470Ω	5
4	voltmeter	MC	(0-20)	2
5	connecting wire	—	—	As per req

Theory:

In electic circuit analysis, nodal analysis, node voltage analysis, or the (branch current method) is a method of determining the voltages b/n nodes in an electrical circuit in terms of branch current.

In analyzing a circuit using Kirchoff's circuit laws, one can either do nodal analysis using Kirchoff's current law or mesh analysis using Kirchoff's voltage law. Nodal analysis writes on eq at each electrical node, requiring that branch currents incident at node must the sum to zero.

Nodal analysis is possible when all circuit elements branch constitutive relations have an admittance representation. Nodal analysis produce a compact set of eq for the network, wch can be solved by hand if small. or can be quickly solved using linear algebra

Practical value

S.NO	V_S	V_1	V_2
1	5	1.2	0.2
2	12	3	0.6
3	19	4.8	0.9
4	21	5.3	1

comparision values

S.NO	Parameters	Practical	Theoritical
1	Vs volts	12	12
2	V1 volts	3	3.12
3	V_2 volts	0.6	0.6

Procedure:-

⟹ connect the circuit as shown in fig,

⟹ vary the supply voltage by steps until 30V

⟹ Note down the values of V_1 & V_2 from the respective voltmeter

⟹ Calculate the voltage values theoritically.

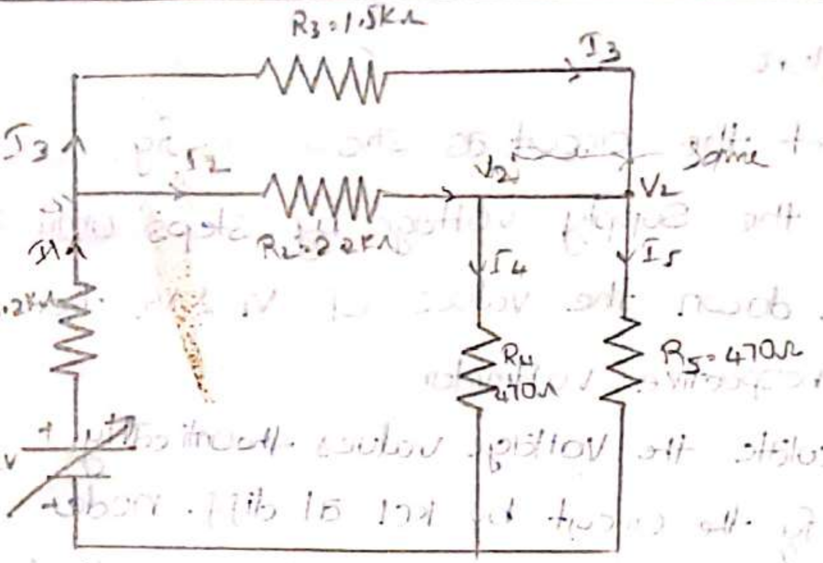
⟹ verify the circuit by KCL at diff. node

⟹ Now compare the theoritical & practical val.

Precautions:

* The voltmeter shd be connecting in ||el
* Avoid loose connection
* Avoid errors in readings

Scanned with CamScanner



Calculation :- At node 2

$I_3 + I_2 = I_4 + I_5$

$\frac{V_1 - V_2}{1.5 \times 10^3} + \frac{V_1 - V_2}{2.2 \times 10^3} = \frac{V_2}{470} + \frac{V_2}{470}$

$\frac{V_1 - V_2}{1.5} + \frac{V_1 - V_2}{2.2} = \frac{10^3 \times 2}{470} (V_2)$

$1.12V_1 - 1.12V_2 = 4.25V_2$

$1.12V_1 - 5.37V_2 = 0$ — (1)

At node -1 :-

$I_1 = I_2 + I_3$

$\frac{V_S - V_1}{R_1} = \frac{V_1 - V_2}{2.2} + \frac{V_1 - V_2}{1.5}$

$\frac{12 - V_1}{3.2} = \frac{1.5(V_1 - V_2) + 2.2(V_1 - V_2)}{3.3}$

$-3.3V_1 + 39.6 = 11.84(V_1 - V_2)$

$15.14V_1 - 11.84V_2 = 39.6$ — (2)

By solving (1) & (2)

$V_1 = 3.12V. \quad V_2 = 0.6V$

$I_3 = \frac{3.12 - 0.6}{1.5} = 1.68mA \quad I_2 = 1.14mA$

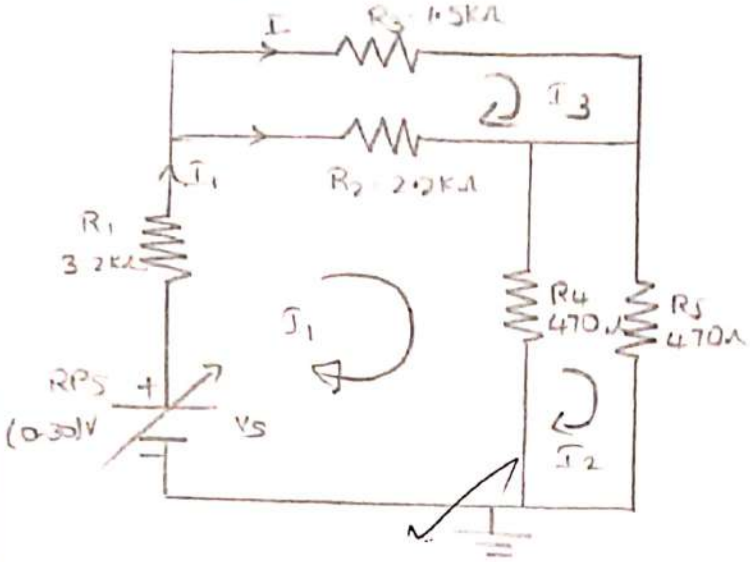
$I_4 = 1.2mA \quad I_5 = 1.2mA \quad I_1 = 2.7mA$

$I_3 + I_2 = I_4 + I_5$

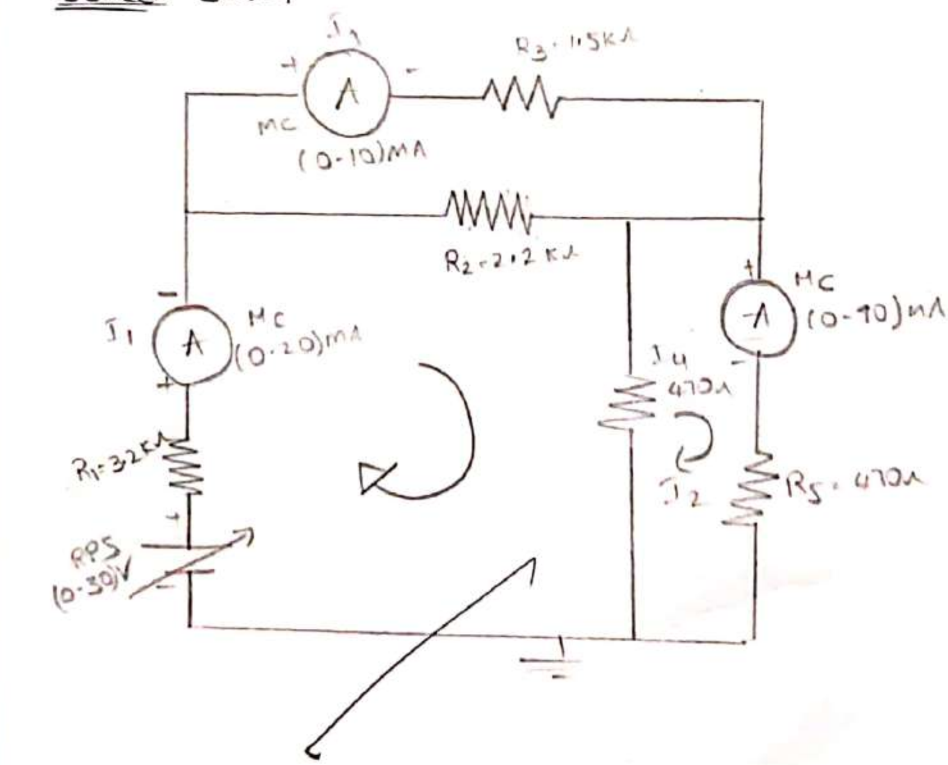
$I_1 = I_2 + I_3$

Result :- Hence nodal analysis of theoritical & practical values are verified

Theoritical circuit



Practical circuit



Date:- /02/2020 Experiment no:- 03

Mesh-Analysis

Aim:- To analyze the branch currents in the meshes (loops)

Materials required

S.No	Name of material	Type	Range	Quantity
1	Bread board	Variable	-	1
2	RPS	Variable	(0-30)V	1
3	Ammeters	MC	(0-20)mA	3
4	connecting wires	—	—	As per req.
5	Patch cards	—		"
6	Resistors	—	3.2KΩ, 2.2KΩ, 1.5KΩ, 470Ω, 470Ω	5

Procedure:

i) Find the meshes (loops) for the given circuits & mark the currents for the branches of circuit as shown in practical circuit

ii) connect the circuits as shown in of mesh analysis

iii) connect the Ammeters in series to the Resistors as shown in given circuit

iv) By varying the voltage in the RPS note down the values of current I_1, I_2, I_3 in the tabular colum

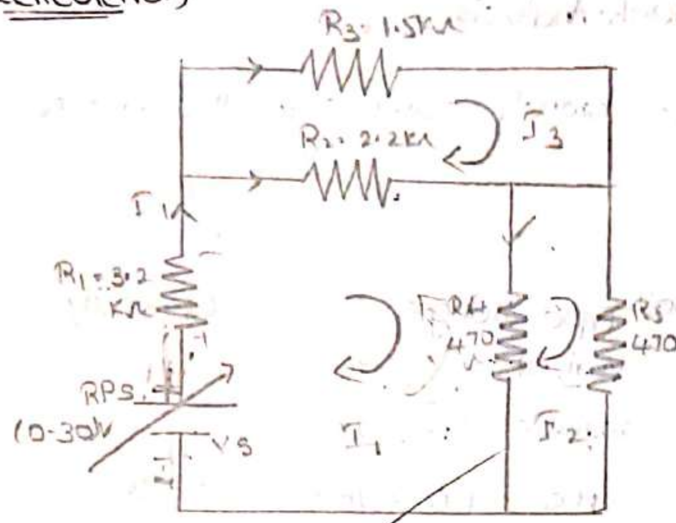
v) For finding the theoritical values use KVL & find a branch currents in the given circuit

vi) Analyse the theoritical & practical val. in the given circuit

Theory

Mesh analysis is a method that is used to solve planar circuit for the currents at any place in the electrical circuit. Planar circuits are circuits ~~that are~~ can be drawn on a plane surface with no wires crossing each other. A more general technique, called

Calculation



At loop 1 :-

$-(V_S = 3.2 I_1 - 2.2 (I_1 - I_3) - 0.47 (I_1 - I_2) = 0$

$V_S - 3.2 I_1 - 2.2 I_1 + 2.2 I_3 - \underbrace{0.47 I_1} + 0.47 I_2 = 0$

$\cancel{(V_S - 3.2 I_1 - 2.2 I_1 + 2.2 I_3)} \times$

$V_S - 5.87 I_1 + 0.47 I_2 + 2.2 I_3 = 0$

$5.87 I_1 - 0.47 I_2 - 2.2 I_3 = V_S$ — (1)

At loop 2 :-

$-0.47 I_2 + 0.47 (I_2 - I_1) = 0$

or $-0.47 I_2 + 0.47 I_1 - 0.47 I_2 = 0$

$-0.94 I_2 + 0.47 I_1 = 0$

$I_1 - 2 I_2 = 0$ — (2)

At loop 3 :-

$-1.5 I_3 + 2.2 (I_1 - I_3) = 0$

$-1.5 I_3 + 2.2 I_1 - 2.2 I_3 = 0$

$-3.7 I_3 + 2.2 I_1 = 0$

$2.2 I_1 - 3.7 I_3 = 0$

$I_1 = 2.77 mA$ $\quad I_2 = 1.3 mA$ $\quad I_3 = 1.64 mA$

loop analysis can be applied to any circuit, planar or not

Mesh analysis & loop analysis both make use of KVL to arrive at a set of equations guaranteed to be solvable if the circuit has a solution

Precautions

The ammeter should be connected in series

Avoid loose connections

Avoid errors in readings

Practical readings

S.NO	Vs(volts)	I_1 (mA)	I_2 (mA)	I_3 (mA)
1	5	1.3	0.8	0.6
2	10	2.3	1.6	1.3
3	12	2.7	1.9	1.6
4	20	5	2.3	2

comparision table

S.NO.	Parameter	Theoritical	Practical
1	Vs (volts)	12	12
2	I_1 (mA)	2.7	2.7
3	I_2 (mA)	1.84	1.9
4	I_3 (mA)	1.64	1.6

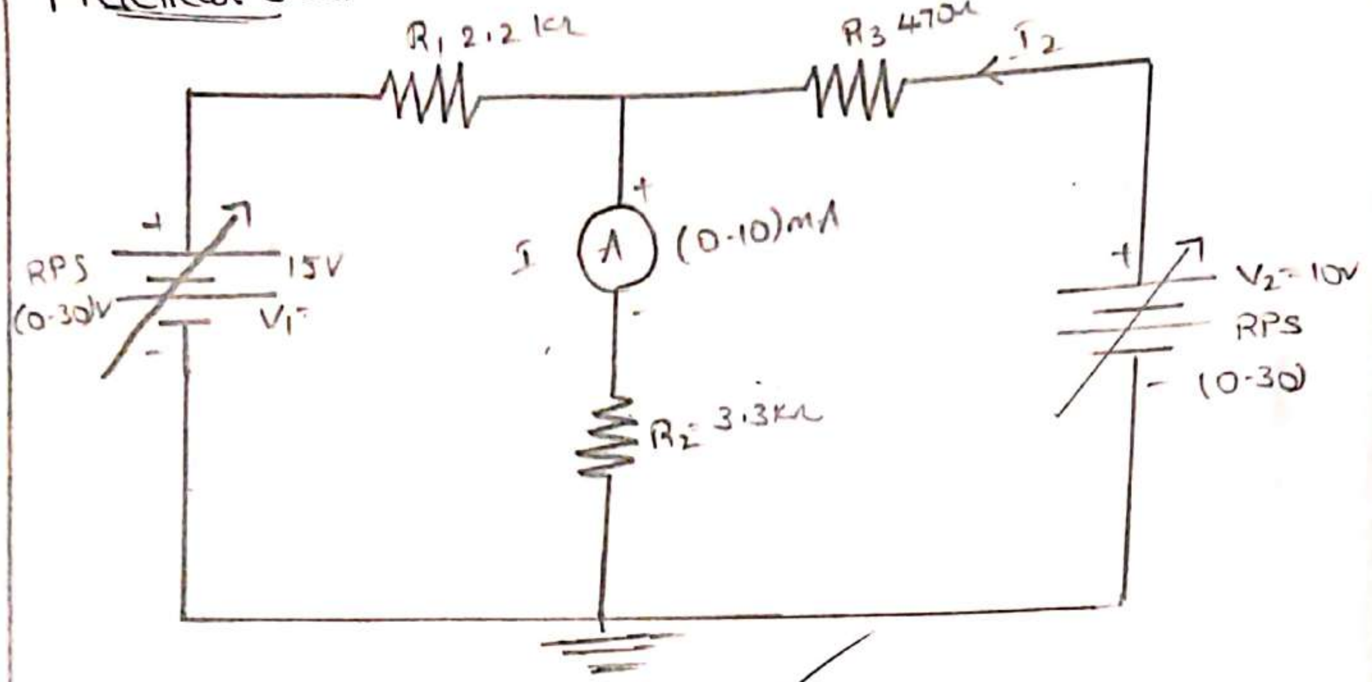
Scanned with CamScanner

Result :- Hence the mesh analysis was completed

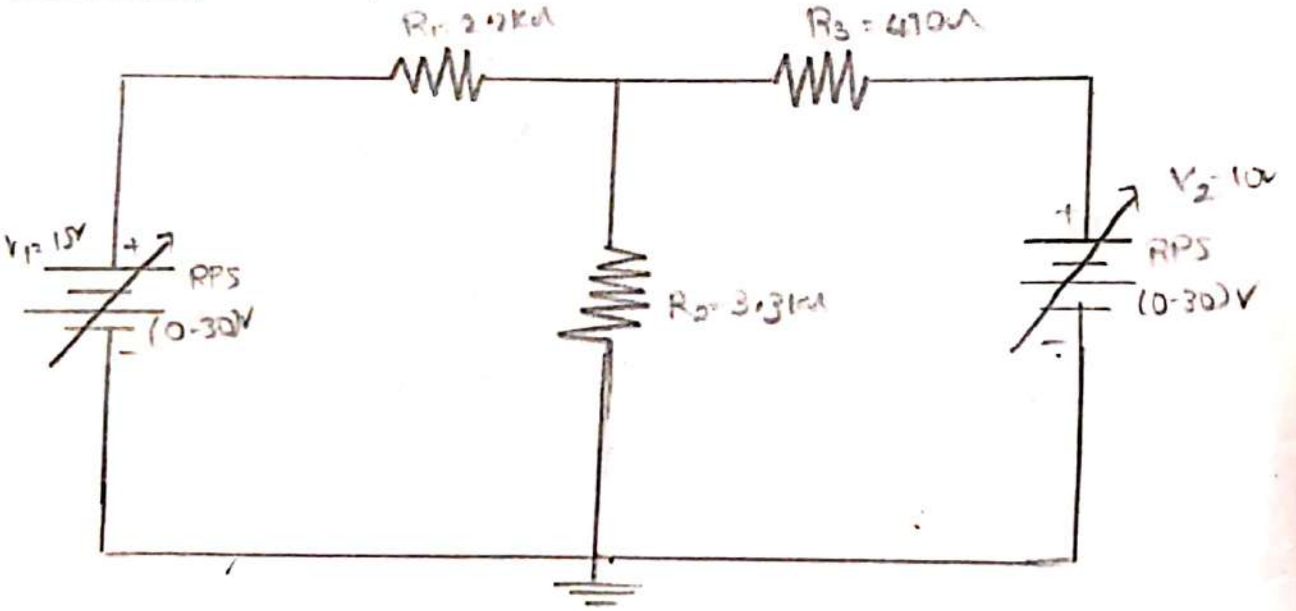
Date :- 17/02/2020

Experiment no: -

Practical circuit



Theoritical circuit



17/2/2020

3(a). Verification of Superposition Theorem

Aim:- To verify the superposition theorem

Apparatus required:

S.NO	Apparatus	Type	Range	Quantity
1.	RPS	Variable	(0-30)V	2
2	Resistors	–	2.2kΩ, 3.3kΩ, 470Ω	3
3	Ammeter	MC	(0-20) mA	1
4	Patch cords	–	–	As per req
5	connecting wire	–	–	"

Statement:- Superposition th. states that for a linear sys the response in any branch of a bilateral linear circuit hvg more than one independent source equal to algebraic sum of response caused by independent source acting alone, wr. all other independent source are replaced by their internal independence

Theory

The superposition (States) th. for electrical circuits states that for a linear sys the responce (voltage or current) in any branch of a bilateral linear circuit hvg more than one indep. source equals the algebraic sum of responses caused by each independent source acting alone, wr. all the other. indep. sources are replaced by their internal impedence.

Scanned with CamScanner

Practical Readings with 2 sources:

S.NO	V_1(V)	V_2(V)	I (mA)	I_1(mA)	I_2 (mA)
1	10	5	1.9	0.5	1.3
2	15	10	3.49	1	2.5
3	20	15	5	1.5	4
4	25	20	6.6	2	2.5

When V_1 is shorted

S.NO	V_1(V)	I_1(mA)
1	5	1.3
2	10	2.5
3	15	4
4	20	2.5

When V_2 is shorted

S.NO	V_2(V)	I_2(mA)
1	10	0.5
2	15	1
3	20	1.5
4	25	2

Comparision table :-

S.NO	Parameter	Practical	Theoritical
1	V_1 (volt)	15	15
2	V_2 (volt)	10	10
3	I_1 (mA)	1	0.6
4	I_2 (mA)	2.5	2.4
5	I (mA)	3.4	2.94

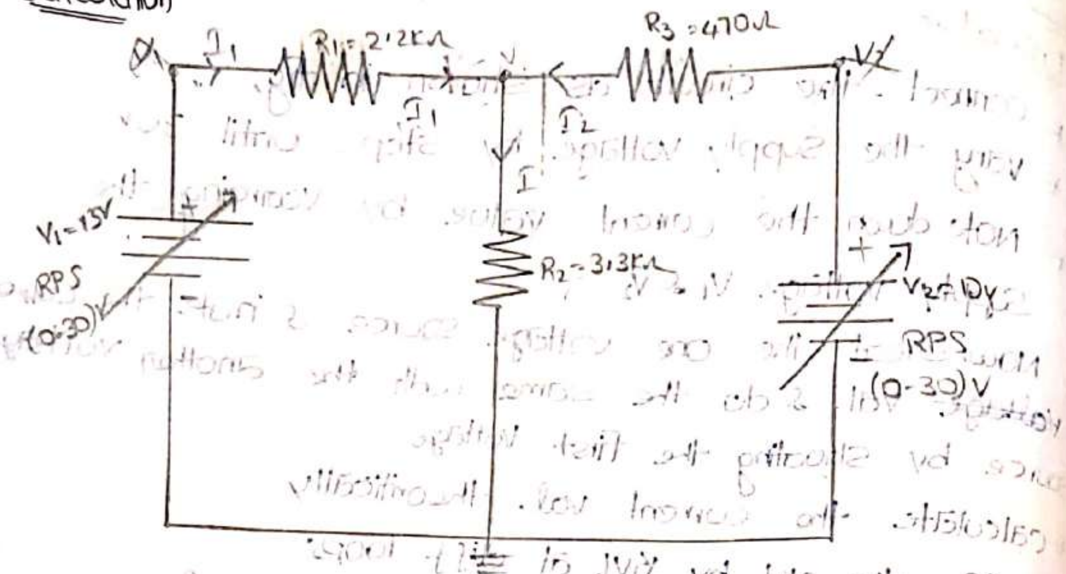
Procedure

* connect the circuit as shown in fig;
* Vary the supply voltage by steps until 30V
* Note down the current value by varying the supply voltage V_1 & V_2
* Now, short the one voltage source & note the current ~~voltage~~ val. & do the same with the another voltage source by shorting the first voltage
* calculate the current val. theoritically
* Verify the ckt by KVL at diff loops
* Now compare the theoritical & practical val

Precaution

* The Ammeter shd be connected in series
* Avoid loose connections
* Avoid errors ~~in~~ readings

Calculation



Given $V_1 = 15V$ $V_2 = 10V$ $R_1 = 2.2k\Omega$ $R_2 = 3.3k\Omega$ $R_3 = 470\Omega$

At node V :-

$$I_1 + I_2 = I \implies \frac{V_1 - V}{R_1} + \frac{V_2 - V}{R_3} = \frac{V}{R_2}$$

$$\frac{15 - V}{R_1} + \frac{10 - V}{470} = \frac{V}{3.3\times10^3}$$

$$\frac{15}{2.2\times10^3} - \frac{V}{2.2\times10^3} + \frac{10}{470} - \frac{V}{470} = \frac{V}{3.3\times10^3}$$

$$\frac{1.5}{2.2\times10^3} + \frac{10}{470} = \frac{V}{2.2\times10^3} + \frac{V}{3.3\times10^3} + \frac{V}{470}$$

$$\frac{0.015}{2.2} + \frac{1}{47} = \frac{1}{10^3}\left(\frac{5.5V}{7.26}\right) + \frac{V}{470}$$

$$0.0068 + 0.0212 = \frac{1}{10^3}(0.75)V + \frac{V}{470}$$

$$0.028 = (2.87\times10^{-3})V$$

$$V = \frac{0.028\times10^3}{2.87} = \frac{28}{2.87} = 9.75V$$

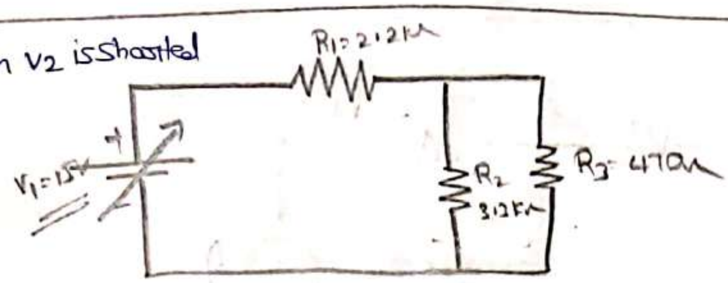
$$I_1 = \frac{15 - 9.75}{2.2\times10^3} = 2.39\,mA$$

$$I_2 = \frac{10 - 9.75}{470} = 0.5\,mA$$

$$I_3 = \frac{9.75}{3.3\times10^3} = 2.89\,mA$$

Scanned with CamScanner

when V_2 is shorted



$$R_{eq} = R_1 + \frac{1}{R_2} + \frac{1}{R_3} = 2200 + \frac{1}{3300} + \frac{1}{470} = 2200.02\Omega$$

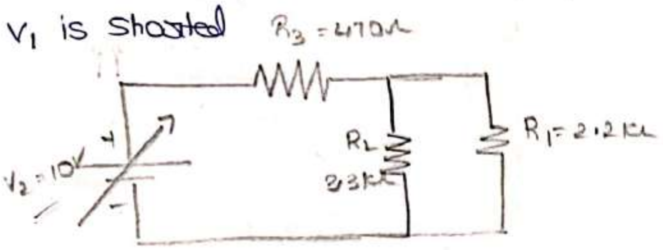
$$I = \frac{V_1}{req} = \frac{15}{2611.4} = 5.7mA$$

$$I_1 = \frac{5.7 \times 470}{3770\cancel{0}} = 0.7mA \qquad I_1 = \frac{\text{Total } (I) \times \text{OPP. resis}}{\text{Total resis.}}$$

Similary $I_2 = 4.98 \text{ mA}$

$$I = I_1 + I_2$$

when V_1 is shorted



$$R_{eq} = R_3 + \frac{1}{R_2} + \frac{1}{R_1} = 470 + \frac{1}{3300} + \frac{1}{2200} = 1790\Omega$$

$$I = \frac{V_2}{R_{eq}} = \frac{10}{1790} = 5.5mA$$

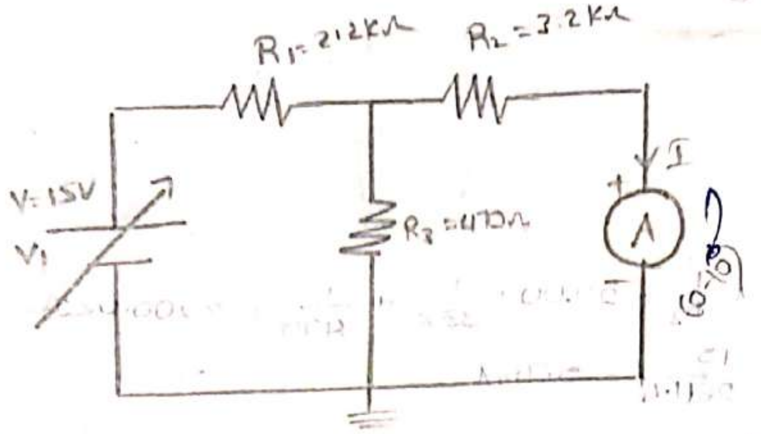
$$I_1 = \frac{\text{Total current} \times \text{OPP. resis}}{\text{total resis.}} = \frac{5.5 \times 2200}{5500}$$

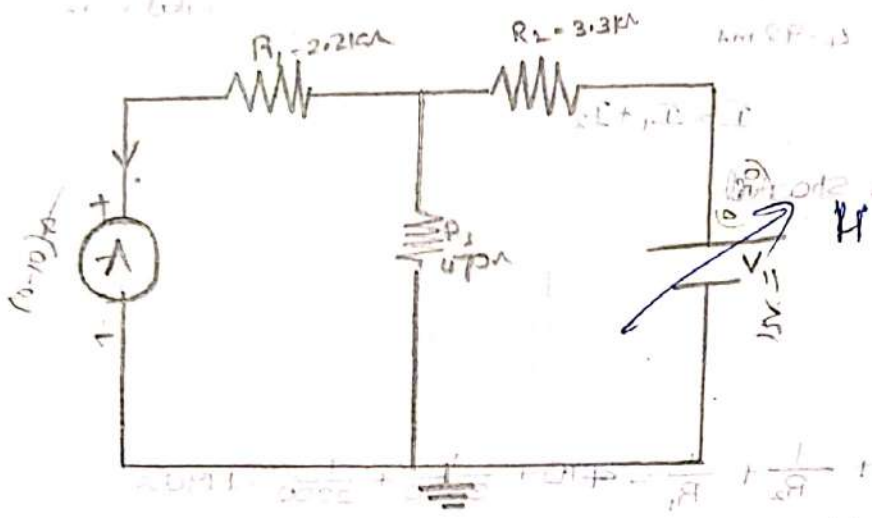
$I_1 = 2.2mA$, Similarly $I_2 = 3.3mA$

$$I = I_1 + I_2$$

Result:

Hence the superposition theorem is verified


R1=2.2KΩ
R2=3.2KΩ
V=15V
V1
R3=470Ω
I


R1=2.2KΩ
R2=3.3KΩ
R3
470Ω

3b- Verification of Reciprocality theorem

Aim:- To verify the reciprocity theorem.

Apparatus

S.NO	Name of experiment	Quantity	Range
1.	Bread board	1	—
2	RPS	1	(0-30)V
3	Ammeter	1	(0-10)mA
4	Resistor	3	2.2KΩ, 3.3KΩ, 470Ω
5	connecting wires	As per req.	—
6	Patch cords		

Statement :-

In any (bilateral linear) network containing one (or) more independent sources. The ratio of voltage s (v) introduced in one mesh to current (I) in any second mesh is same as ratio obtained if the position of voltage & current are interchanged.

Procedure :

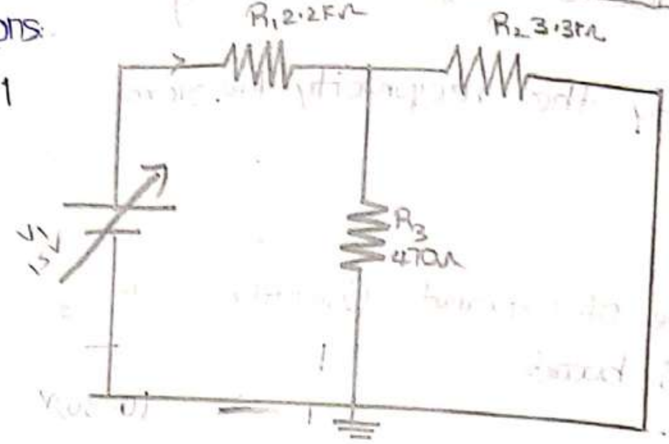
1) Connect the circuit as shown in fig;
2) Note down the practical val. for I_1 by varying V_1
3) ~~By~~ Now connect the circuit as shown in fig.
4) Repeat the same procedure as in the case of circuit-1
5) calculate the current val. theoritically
6) compare practical & theoritical values.

Theory:-

* In the complete form, the reciprocity th. states that if an emf 'E' in one branch of reciprocal network 'I' in another if emf moved from first to 2nd branch.
* Then if the emf has been replaced by short circuit
* Here the voltage source & the ammeter used in this theorem must be ideal.

Calculations.

circuit 1



$V_1 = 15V \quad R_1 = 2.2K\Omega \quad R_3 = 3.3K\Omega \quad R_2 = 470\Omega$

$$R_{eq} = R_1 + \left(\frac{1}{\frac{1}{R_2} + \frac{1}{R_3}}\right) = 2200 + \left(\frac{1}{\frac{1}{3300} + \frac{1}{470}}\right) =$$

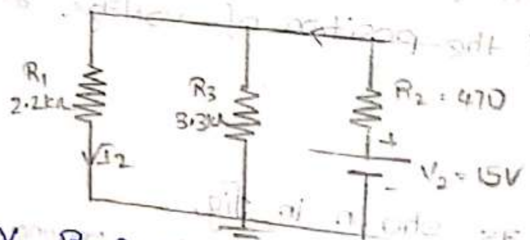
$$R_{eq} = 2200 + \frac{(3300 \times 470)}{3300+470} = 2200 + 411.4$$

$R_{eq} = 2611.4\Omega$

$$I = \frac{V_1}{R_{eq}} = \frac{15}{2611.4} = 5.7mA$$

$$I_1 = \frac{I \times R_3}{total} = \frac{5.7 \times 3300}{3770} \Rightarrow I_1 = 4.98mA$$

Circuit - 2



Thg in mesh

$V_1 = 15V, \; R_1 = 2.2K\Omega \quad R_2 = 470 \quad R_3 = 3.3K\Omega$

$$R_{eq} = R_2 + \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)} = 470 + \left(\frac{2200 \times 3300}{2200+3300}\right) = 1790\,\Omega$$

$$I = \frac{V_2}{R_{eq}} = \frac{15}{1790} = 8.3mA$$

$$I_2 = \frac{I \times R_3}{R_{total}} = \frac{8.3 \times 3300}{5500} = 4.98mA$$

$$\frac{V_1}{I_1} = \frac{15}{4.98} \quad \& \quad \frac{V_2}{I_2} = \frac{15}{4.98} \Rightarrow \therefore \boxed{\frac{V_1}{I_1} = \frac{V_2}{I_2}}$$

Scanned with CamScanner

Precautions

The ammeter should be connected in series.

Avoid loose connections

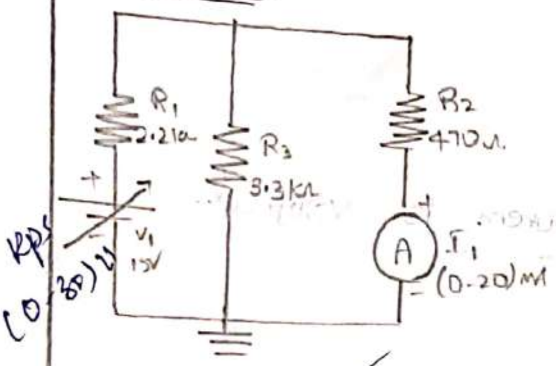
Avoid errors.

Result

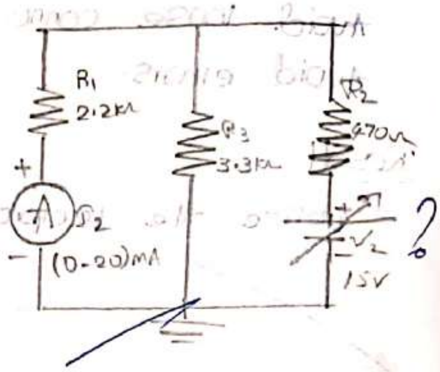
Hence the reciprocity theorem is verified.

Practical Circuit Diagram:-

Circuit - 1:-



circuit -2:-



Practical Readings

Circuit - 1:-

S.NO	V_1(V)	I_1 (mA)
1	5	1.6
2	10	3.3
3	15	5.0

Circuit - 2:-

SNO	V_2(V)	I_2 (mA)
1	5	1.6
2	10	3.3
3	15	5.0

Theoritical Readings

circuit - 1

SNO	V_1(V)	I_1(mA)
1	15	4.98

circuit -2 :-

SNO	V_2(V)	I_2(mA)
1	15	4.98

comparision table

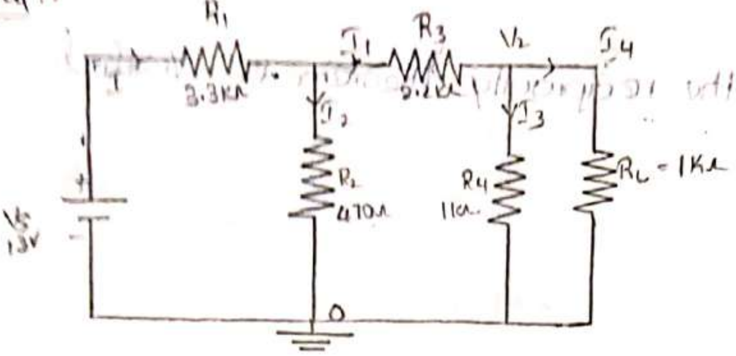
SNO	Parameters	Practical	Theoritical
1	V_1(V)	15	15
2	V_2(V)	15	15
3	I_1(mA)	5	4.98
4	I_2(mA)	5	4.98
5	$\frac{V_1}{I_1} = R_1(\Omega)$	3	3.01
6	$\frac{V_2}{I_2} = R_2(\Omega)$	3	3.01

Scanned with CamScanner

Result :-

Hence the reciprocity theorem is verified.

Theoretical:-



Calculation:-

Step-1 :- Finding node voltage V_1 & V_2

At node (V_1) : $I = I_1 + I_2 \Rightarrow \frac{V_1-V_2}{R_3} + \frac{V_1}{R_2} = \frac{V_S-V_1}{R_1}$

$$\frac{13-V_1}{3300} = \frac{V_1-V_2}{2200} + \frac{V_1}{470}$$

$$2.88V_1 - 0.45V_2 = 3.92 \text{ — (1)}$$

At node V_2 : $I_1 = I_3 + I_4$

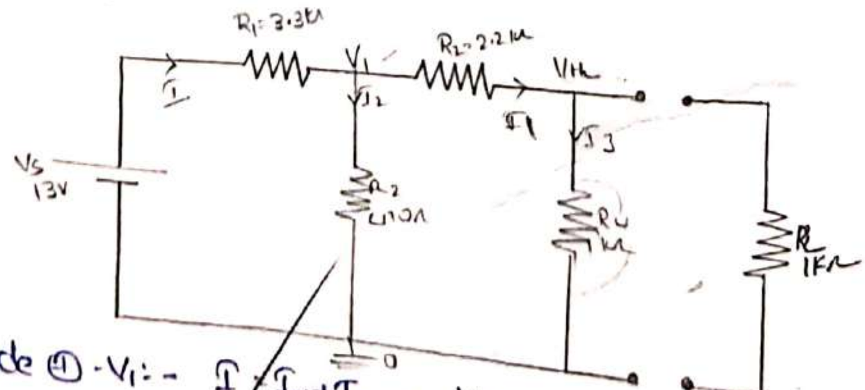
$$\frac{V_1-V_2}{R_3} = \frac{V_2}{R_4} + \frac{V_2}{R_L}$$

$$\frac{V_1-V_2}{2200} = \frac{V_2}{1000} + \frac{V_2}{1000}$$

$$5V_1 - 5V_2 = 22V_2 \Rightarrow 5V_1 - 27V_2 = 0 \text{ — (2)}$$

$V_1 = 1.4V$, $V_2 = 0.26V$

Step-2 Finding open circuit voltage (V_{th}):-



At node (1) $\cdot V_1$:- $I = I_1 + I_2$ = $\frac{V_S-V_1}{R_1} = \frac{V_1-V_2}{R_3} + \frac{V_1}{R_2}$

$$\frac{13-V_1}{3300} = \frac{V_1-V_2}{2200} + \frac{V_1}{470} \text{ — (1)}$$

$$2.88V_1 - 0.45V_2 \;\; 3.92 \text{ - (1)}$$

At node V_{th} : $I_1 = I_3 \rightarrow \frac{V_1-V_{th}}{2200} = \frac{V_{th}}{1000}$

$$10V_1 - 32V_{th} = \text{ — (3)}$$

$V_1 = 1.4V$, $\boxed{V_{th} = 0.43\ V}$

Scanned with CamScanner

9/03/2020

4(a). Verification of Thevenin's Theorem

Aim :- To verify Thevenin's theorem

Apparatus :-

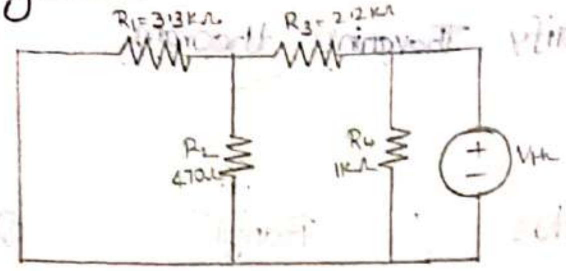
S.NO	Apparatus	Range	Quantity
1	RPS	(0-30) V	1
2	Resistors	3.2KΩ, 470Ω, 2.2KΩ 1KΩ - 2	5
3	Ammeter	(0-20) mA	1
4	Voltmeter	(0-20) V	1
5	Patch chords	—	As per requirement
6	Connecting wires	—	

Statement :- It states that a linear 2 terminal circuit can be replaced with equivalent circuit consisting of V_{th} in series with R_{th} where V_{th} is open circuit voltage at terminals & R_{th} is equivalent resistance ~~of~~ at terminals where all independent sources are turned off.

Theory

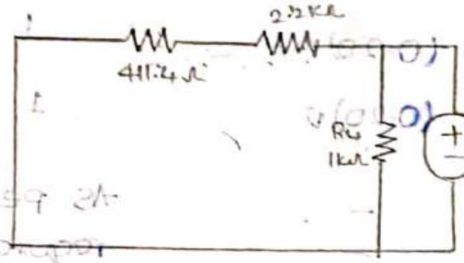
* Any combination of batteries & resistances with 2 terminal can be replaced by a single voltage source & a single resistor
* The val. of voltage source is open circuit voltage at terminals, val. of series resistance ø is divided at the current with terminals shoad crcuted
* The Thevein's voltage used in th- is an ideal voltage source is eq to open circuit at terminally.
* Experimentally the ø thevenin's resistance can be found by progressively loading circuit until its output voltage drops to half the open circuit voltage. At that pt. load resistance is equal to thevenin's resis.

Step-3:- finding R_{th} value:-



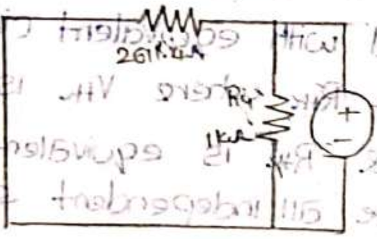
R_1 ||el to R_2

$$\frac{(3300)(470)}{3300+470} = 411.4\,\Omega$$



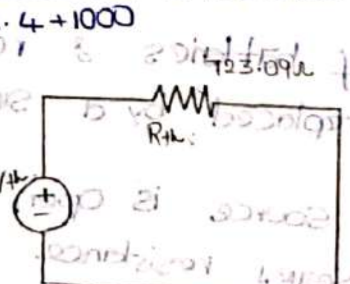
411.4Ω & R_3 are in Series,

$411.4 + 2200 = 2611.4\Omega$



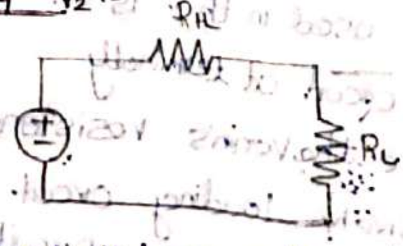
2611.4Ω ||el to R_4,

$$R_{eq} = \frac{(2611.4)(1000)}{2611.4+1000} = 723.09\Omega = R_{th}$$



Step-4:-

Verify V_2:-



from "voltage" division rule,

$$V_2 = \frac{V_{th} \times R_L}{R_L + R_{th}} = \frac{(0.43).(1000)}{(1000)+(723.09)}$$ $\boxed{V_2 = 0.24V}$

Replacing networks by its thevenin's equivalent can simplify the analysis of complex circuit

Procedure

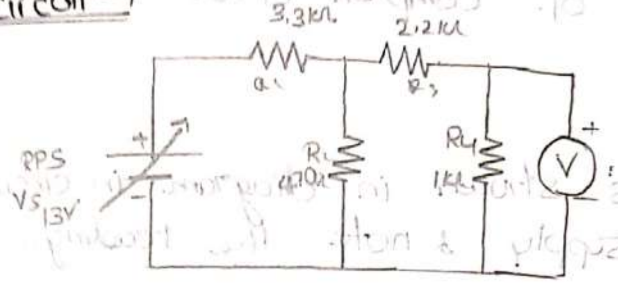
* connect circuit as shown in diagram in circuit 1 & switch on the supply & note the readings of voltmeter
* Repeat the same for diff voltage val. & tabulate the readings.
* Now, connect circuit-2 & calculate Rth.
* compare theoritical & practical values

Precautions :.

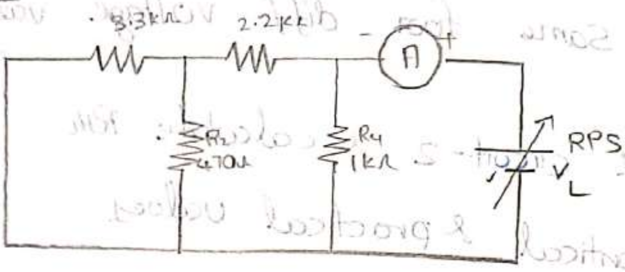
* Avoid loose connections
* Avoid errors

Practical circuit Diagram :-

Circuit - 1



Circuit - 2



Tabular columan of V_{th} voltage

S.NO	Voltage Source (Vs) volts	V_{th} (volts) V_{th} voltage
1	13	0.4

Tabular column for R_{th} Resistance

SNO	Voltage Source Vs (volt)	current (s) mA	R_{th} (Ω)
1	4	5.5	727
2	3	4.1	731

comparision table

S.No	Parameters	Theoretical	Practical
1	V_{th} (volts)	0.43	0.4
2	R_{th} (Ω)	723.09	727

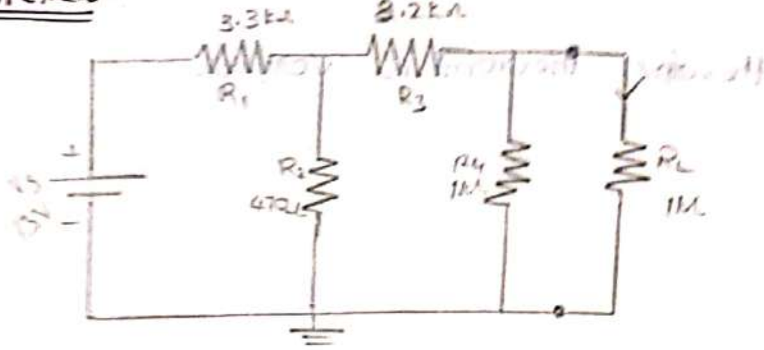
Scanned with CamScanner

Result

Hence thevenin's theorem is verified.

Scanned with CamScanner

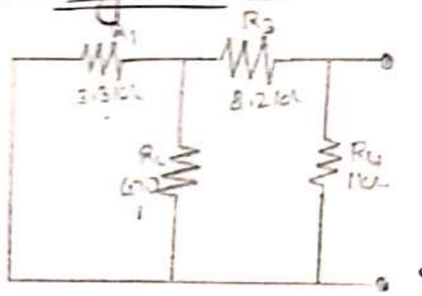
Theoretical :-

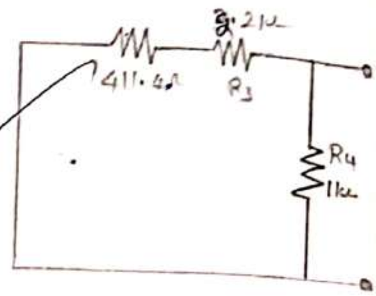


Calculation:

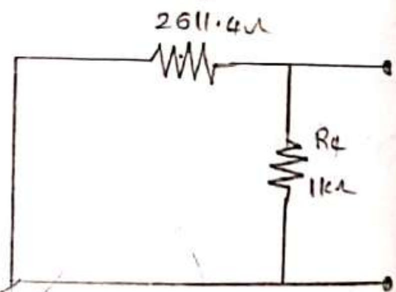
Finding value of RN:-

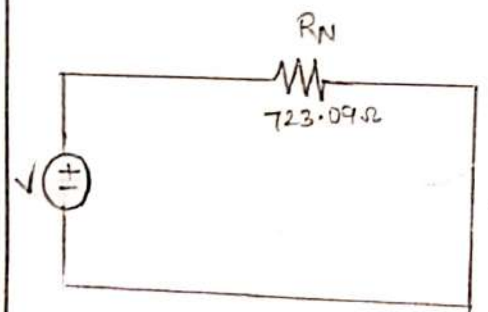
R1 is ||el to R2,





$$\frac{(3300)(470)}{3300+470} = 411.4\Omega$$





411.4Ω & R_3 are in series

411.4 + 2200 = 2611..

2611.4Ω is ||el to R4

$$R_{eq} = \frac{(2611.4)(1000)}{2611.4+1000} = 723.09\Omega = R_N$$

$R_N = 723.09\Omega$

9/3/2020

(4b). Verification of Norton's theorem

Aim:- To verify the Norton's Theorem.

Apparatus:-

SNO	Apparatus	Range	Quantity.
1.	RPS	(0-30)V	1
2	Resistor	3.3KΩ, 470Ω, 2.2K, 1KΩ, 0-2	5
3	Ammeter	(0-20)mA	1
4	Patch chords	–	As per required
5	connecting wires	–	

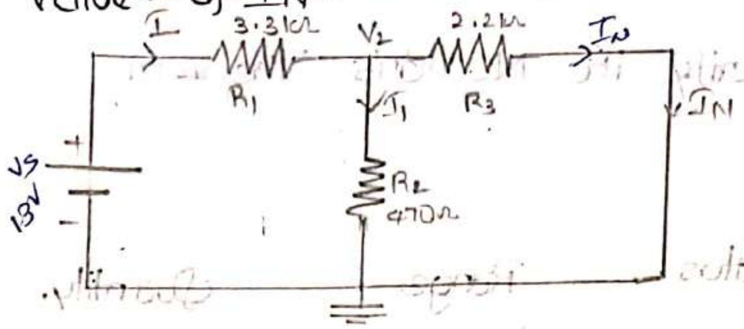
Statement:-

It states that a linear two terminal circuit can be replaced by an equivalent circuit consisting of current source (I_N) in ‖el with a resistor (R_N) where I_N is the short circuited current at load terminal & R_N is equivalent resistor at terminals (load), when independent sources turned off.

Procedure:-

connect the circuit as shown in fig;
From theoretical circuit by applying nodal (or) mesh analysis find the current as I_L.
Note down the current as I_L.
Now by making voltage source (or) RPS as short, find the equivalent resistance by removing 1KΩ (R) as shown.
Note down the equivalent resistance at R_N &
now making 1KΩ (R_L) as short find out the current across 470Ω by using nodal analysis.

Finding value of I_N:-



at node V_1:-

$$\hat{I} = I_1 + I_N \Rightarrow \frac{13 - V_1}{R_1} = \frac{V_1}{R_2} + \frac{V_1}{R_3}$$

$$\frac{13 - V_1}{3300} = \frac{V_1}{470} + \frac{V_1}{2200}$$

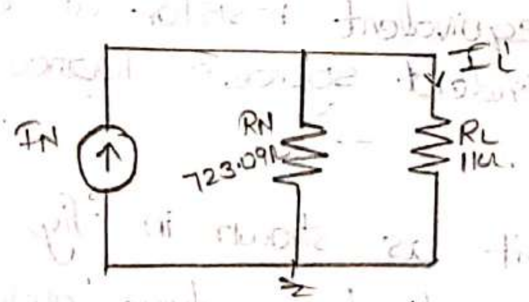
$$\frac{13}{3300} = V_1\left(\frac{1}{3300} + \frac{1}{470} + \frac{1}{2200}\right)$$

$$\frac{13}{3300} = V_1\left(2.88 \times 10^{-3}\right) \Rightarrow V_1 = 1.36V$$

$$\therefore I_N = \frac{V_1}{R_3} = \frac{1.36}{2200} = 0.618\,mA$$

$$\boxed{I_N = 0.618\,mA}$$

Finding value of I_L':-



By current division rule:-

$$I'_L = \frac{(I_N) \times (R_N)}{R_N + R_L}$$

$$I_L' = \frac{(0.618)(723.09)}{723.09 + 1000} = 0.25\,mA$$

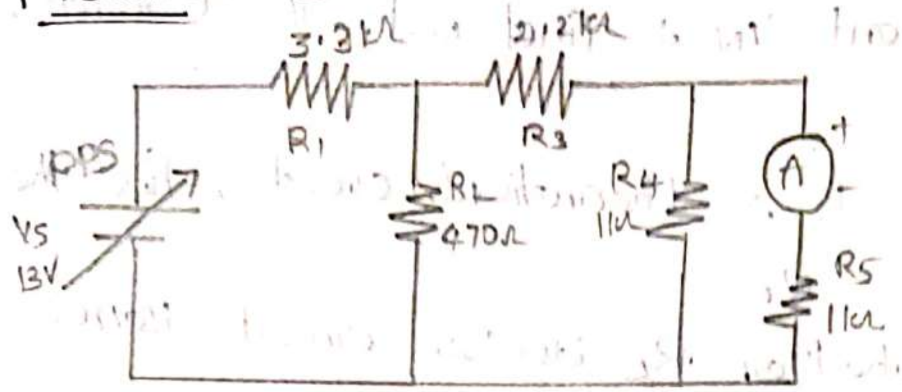
$$\boxed{I_L' = 0.25\,mA}$$

* Now, name the curent as I_N.
* Note down the curent I_N & find out the curent I_L across R_L.
* Now, from practical & theoratical circuit, find the current I_L across R_L.
* Now compare whether R_L across circuit Hence Norton's theorem is proved.

Precautions:

* Avoid loose connections
* Avoid errors

Practical circuit.



Tabular coloumn for practical values:-

S NO	Vs(V)	I_L(mA)
1	5	0.1
2	13	0.2
3	20	0.4.

comparision Table

Parametars	Theoretical	Practical
I_L(mA)	0.25	0.2

Result :- Hence Norton's theorem is Verified