North South University
Department of Electrical & Computer Engineering

LAB REPORT

Course Code : EEE 141L
Course Title: Electrical Circuits Lab
Course Instructor: Faculty Name M Abu Obaidah
Experiment Number: 02
Experiment Name:

KCL, Current Divider Rule with Parallel and Ladder Circuit.

Experiment Date: 27/06/2018
Date of Submission: 04/07/2018
Section: 08
Group Number: 07
Submitted To: Lab Instructor Name Sanjida Islam

Submitted By	Score
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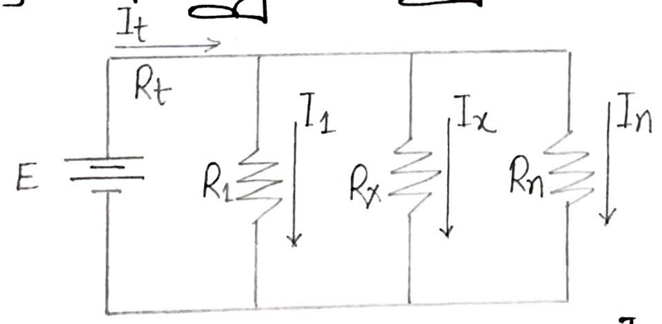
Objectives:

- Learn how to connect a parallel circuit on a breadboard.
- Validate the current divider rules.
- Verify Kirchhoff's current law.
- Verify KCL and KVL in ladder circuit.

Theory:

The current divider rule states that the electrical current entering the node of a parallel circuit is divided into the branches. Current divider rule is employed to calculate the magnitude of divided current in the circuits.

A parallel circuit with 'n' number of resistors and an input voltage source is illustrated below. We are interested to find the current which is flowing through R_x.



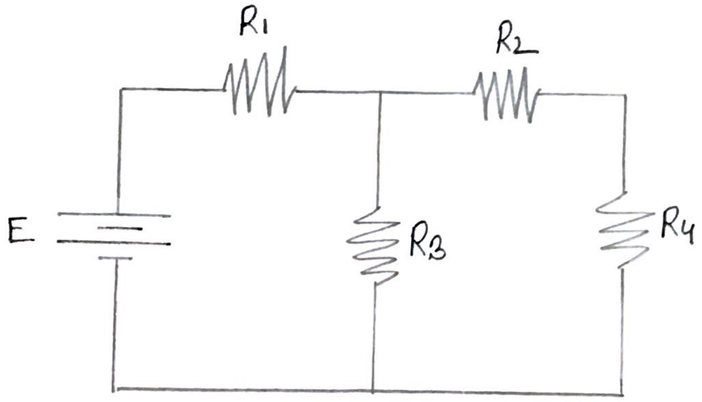
Current divider formula: $I_x = \frac{I_t}{R_x} R_t$

The Kirchhoff's current law (KCL) states that, the algebric sum of the current entering and leaving a junction of a network is equal to zero. In equation form, the above statement can be written as, follows :

$$\sum I_i = \sum I_o$$

with I_i representing current entering, and I_o representing current leaving.

The combination of series and parallel circuit is called ladder circuit. The following circuit represent an example of a ladder circuit.



A color code use to indicate the values or ratings of electronic components, usually for resistors, but also for capacitors, inductors, diodes and others.

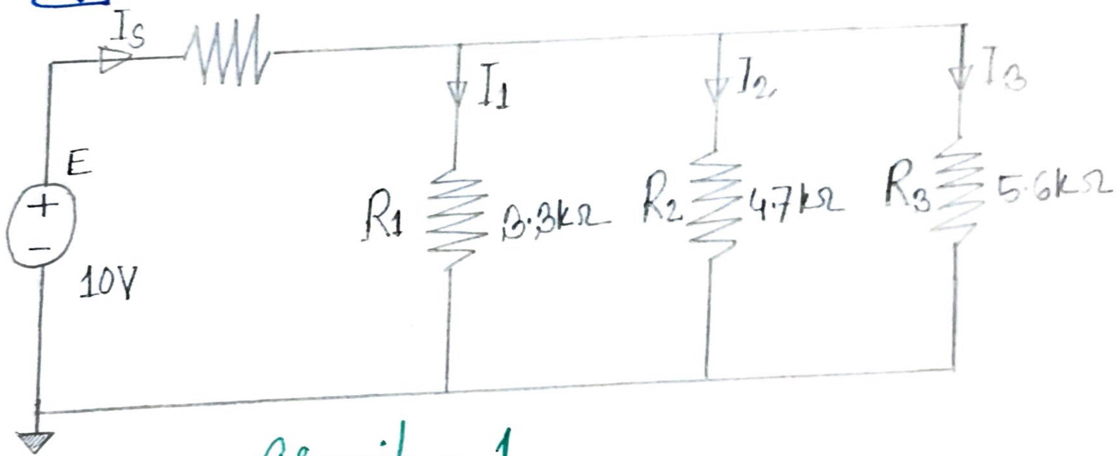
The colored band on a resistor can tell you everything you need to know about its value and tolerance, as long you understand how to read them.

As we mention before, the ladder circuits represents a commonly used circuit style that is configured purely on the basis of series and parallel connection.

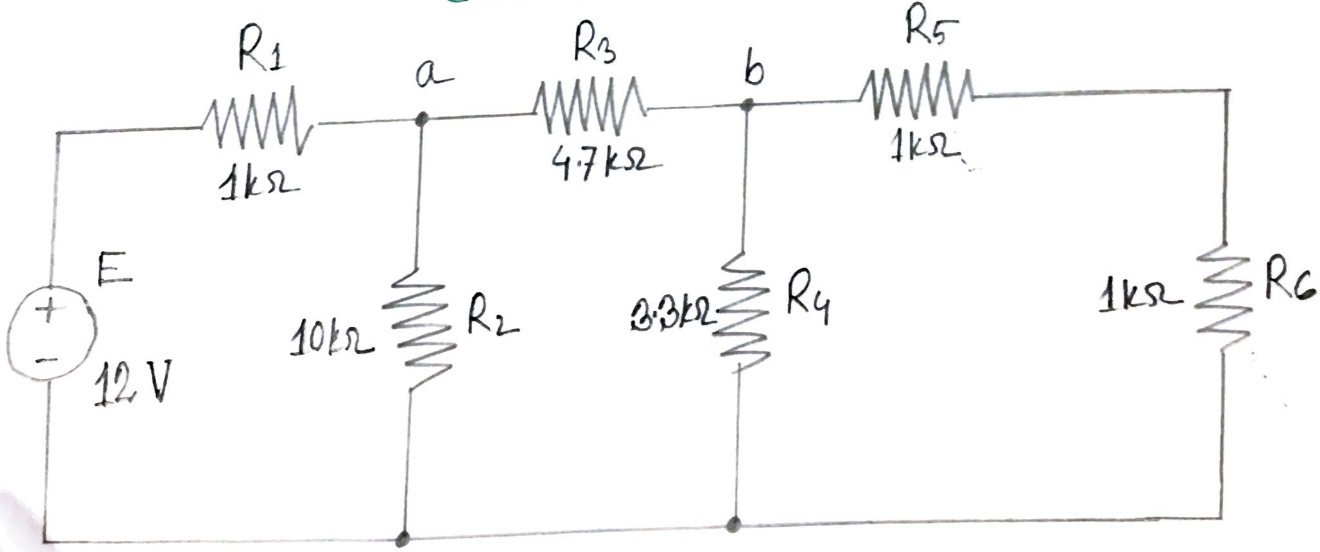
Apparatus List :

1. Trainer board.
2. [illegible]stors (1kΩ, 3.3kΩ, 4.7 kΩ, 5.6
3. Digital Multimeter (DMM).
4. Connecting Wire.

Circuit Diagram :



Circuit - 1

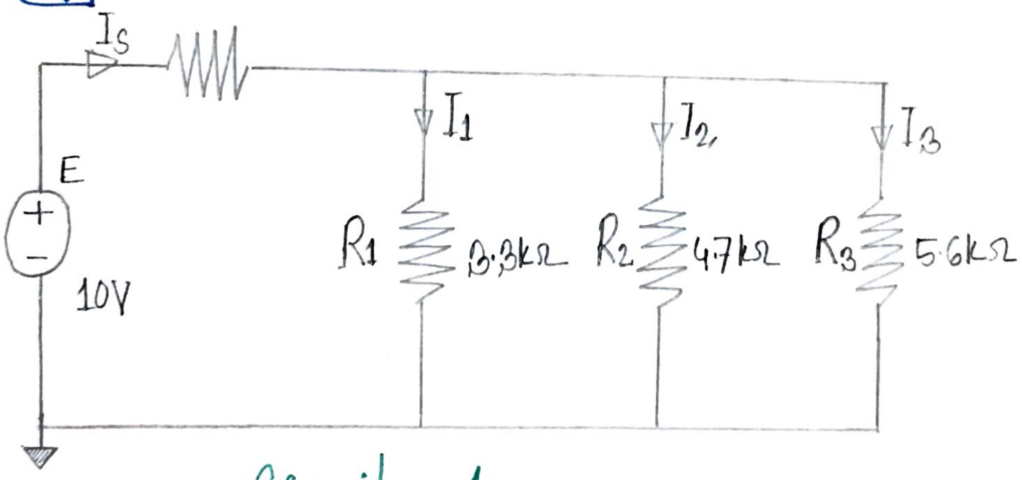


Circuit -2

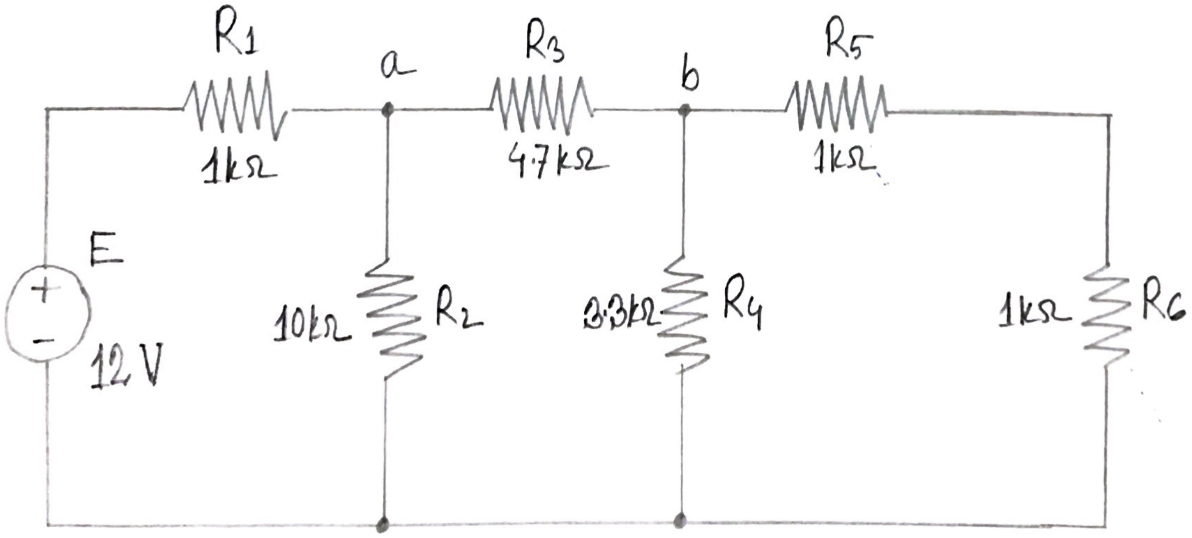
Apparatus List :

1. Trainer board.
2. Resistors (1kΩ, 3.3kΩ, 4.7 kΩ, 5.6 kΩ, 10kΩ).
3. Digital Multimeter (DMM).
4. Connecting Wire.

Circuit Diagram :



Circuit - 1



Circuit-2

Data and Results :

For 1ST Circuit :

Table-1

Supply Voltage	Experimental readings			
V_s	V_s	V_1	V_2	V_3
5	4.98	2.04	2.92	2.92
10	9.97	4.11	5.88	5.88
15	15.01	6.18	8.85	8.85

Table-2

Experimental Req	Theoretical Req	% Error
2.409	2.44	0.0127049 %

For 2ND Circuit :

Table-1

Supply Voltage	Experimental readings (voltages)						
E	E	R_1	R_2	R_3	R_4	R_5	R_6
5	4.97	1.049	3.92	3.10	0.818	0.402	0.415
10	10.03	2.118	7.91	6.26	1.652	0.814	0.839
15	14.98	3.166	11.82	9.35	2.472	1.277	1.254

Table-2

Experimental Req	Theoretical Req	% Error
4.67	4728	0.012847%

Report :

1. Given from circuit - 1,

$R_1 = 3.3 k\Omega$

$R_2 = 4.7 k\Omega$

$R_3 = 5.6 k\Omega$

$R_0 = 1 k\Omega$

R_1, R_2, R_3 are parallely connected with each other. In parallel connection all 3 resistors have same voltage (V) and R_0 is connected is series with them.

Now, according to ohm's law,

$$\frac{V_s}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\Rightarrow \frac{V_s}{R_{eq}} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\Rightarrow \frac{V_s}{R_{eq}} = V\left(\frac{1}{3.3} + \frac{1}{4.7} + \frac{1}{5.6}\right)$$

$$\Rightarrow \frac{V_s}{R_{eq}} = V \times 0.694$$

$$\therefore V = \frac{V_s}{2.44 \times 0.694} \text{ ------- (i)}$$

For source voltage $V_s = 5V$

$$V = \frac{5}{2.44 \times 0.694} = 2.95\ V$$

$$I_S = \frac{V_s}{R_{eq}} = \frac{5}{2.44} = 2.05\ mA$$

$$I_{R_1} = \frac{V}{R_1} = \frac{2.95}{3.3} = 0.89\ mA$$

$$I_{R_2} = \frac{V}{R_2} = \frac{2.95}{4.7} = 0.63\ mA$$

$$I_{R_3} = \frac{V}{R_3} = \frac{2.95}{5.6} = 0.53\ mA$$

For $V_s = 10V$

$$I_s = \frac{10}{2.44} = 4.098\ mA$$

$$V = \frac{10}{2.44 \times 0.694} = 5.91\ mA$$

$$I_{R_1} = \frac{5.91}{3.3} = 1.79\ mA$$

$$I_{R_2} = \frac{5.91}{4.7} = 1.26\ mA$$

$$I_{R_3} = \frac{5.91}{5.6} = 1.06\ mA$$

For source voltage $V_s = 5V$

$$V = \frac{5}{2.44 \times 0.694} = 2.95 \text{ V}$$

$$I_s = \frac{V_s}{R_{eq}} = \frac{5}{2.44} = 2.05 \text{ mA}$$

$$I_{R_1} = \frac{V}{R_1} = \frac{2.95}{3.3} = 0.89 \text{ mA}$$

$$I_{R_2} = \frac{V}{R_2} = \frac{2.95}{4.7} = 0.63 \text{ mA}$$

$$I_{R_3} = \frac{V}{R_3} = \frac{2.95}{5.6} = 0.53 \text{ mA}$$

For $V_s = 10V$

$$I_s = \frac{10}{2.44} = 4.098 \text{ mA}$$

$$v = \frac{10}{2.44 \times 0.694} = 5.91 \text{ mA}$$

$$I_{R_1} = \frac{5.91}{3.3} = 1.79 \text{ mA}$$

$$I_{R_2} = \frac{5.91}{4.7} = 1.26 \text{ mA}$$

$$I_{R_3} = \frac{5.91}{5.6} = 1.06 \text{ mA}$$

For $V_S = 15$ V,

$$V = \frac{15}{2.44 \times 0.694} = 8.86 \cancel{mA}\ V$$

$$I_S = \frac{15}{2.44} = 6.15\ mA$$

$$I_{R_1} = \frac{8.86}{3.3} = 2.68\ mA$$

$$I_{R_2} = \frac{8.86}{4.7} = 1.89\ mA$$

$$I_{R_3} = \frac{8.86}{5.6} = 1.58\ mA$$

Now let's calculate the practical values,

while experiment we get,

$R_1 = 3.22\ k\Omega$

$R_2 = 4.61\ k\Omega$

$R_3 = 5.49\ k\Omega$

$R_0 = 1\ k\Omega$ $\therefore R_{eq} = 2.409\ k\Omega$

Applying Ohm's law,

$$\frac{V_S}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\Rightarrow \frac{V_S}{R_{eq}} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\Rightarrow \frac{V_S}{R_{eq}} = V\left(\frac{1}{3.22} + \frac{1}{4.61} + \frac{1}{5.49}\right)$$

$$\Rightarrow \frac{V_s}{R_{eq}} = V \times 0.709$$

$$\Rightarrow V = \frac{V_s}{2.409 \times 0.709}$$

For source voltage $V_s = 4.98\ V$

$$V = \frac{4.98}{2.409 \times 0.709} = 2.91\ V$$

$$I_s = \frac{V_s}{R_{eq}} = \frac{4.98}{2.401} = 2.06\ mA$$

$$I_{R_1} = \frac{2.91}{3.22} = 0.9\ mA$$

$$I_{R_2} = \frac{2.91}{4.61} = 0.63\ mA$$

$$I_{R_3} = \frac{2.91}{5.49} = 0.53\ mA$$

For $V_s = 9.97\ V$

$$V = \frac{9.97}{2.409 \times 0.709} = 5.83\ V$$

$$I_s = \frac{V_s}{R_{eq}} = \frac{9.97}{2.401} = 4.138\ mA$$

$$I_{R_1} = \frac{5.83}{3.22} = 1.81\ mA$$

$$I_{R_2} = \frac{5.83}{4.61} = 1.26\ mA$$

$$I_{R_3} = \frac{5.83}{5.49} = 1.06\ mA$$

For $V_s = 15.01$ V

$$V = \frac{15.01}{2.401 \times 0.709} = 8.82 \text{ V}$$

$$I_s = \frac{15.01}{2.401} = 6.25 \text{ mA}$$

$$I_{R_1} = \frac{8.82}{3.22} = 2.73 \text{ mA}$$

$$I_{R_2} = \frac{8.82}{4.61} = 1.91 \text{ mA}$$

$$I_{R_3} = \frac{8.82}{5.49} = 1.60 \text{ mA}$$

Experimental readings					Theoretical values				
V_s	I_s	I_{R_1}	I_{R_2}	I_{R_3}	V_s	I_s	I_{R_1}	I_{R_2}	I_{R_3}
4.98	2.06	0.9	0.63	0.53	5	2.05	0.89	0.63	0.53
9.97	4.138	1.81	1.26	1.06	10	4.098	1.79	1.26	1.06
15.01	6.25	2.73	1.91	1.60	15	6.15	2.68	1.89	1.58

We can see from the table that theoretical and parallel values are very close to each other.

2. Yes. Our circuits follow current division rule.

3. Here, For 1^{ST} circuit,

$$R_{eq} = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}} + R_0$$

$$= \frac{1}{\frac{1}{3.3}+\frac{1}{4.7}+\frac{1}{5.6}} + 1$$

$$= \frac{1}{0.303+0.213+0.178} + 1$$

$$= \frac{1}{0.694} + 1$$

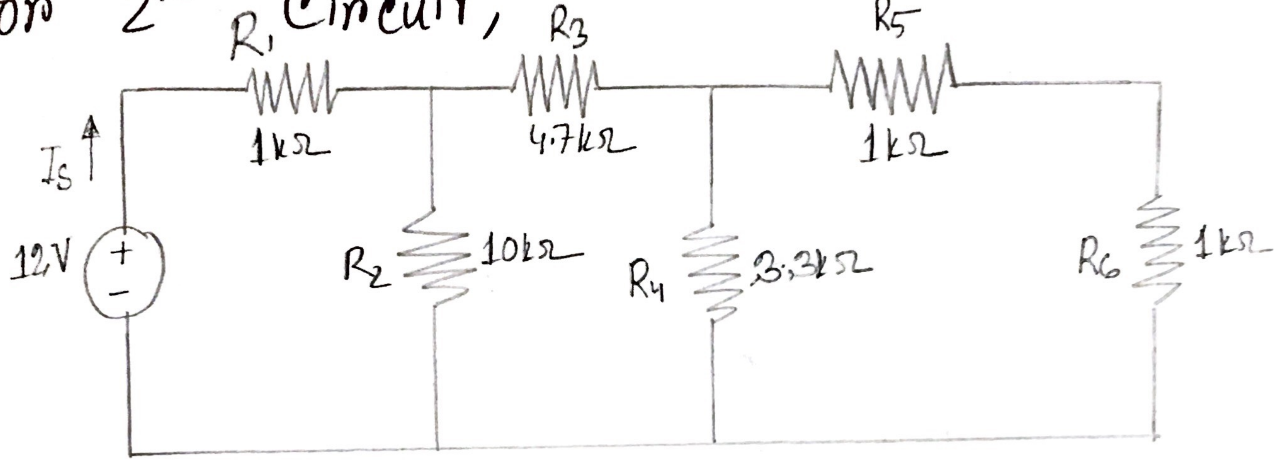
$$= 2.44\ k\Omega$$

Experimentally we got $R_{eq} = 2.409\ k\Omega$

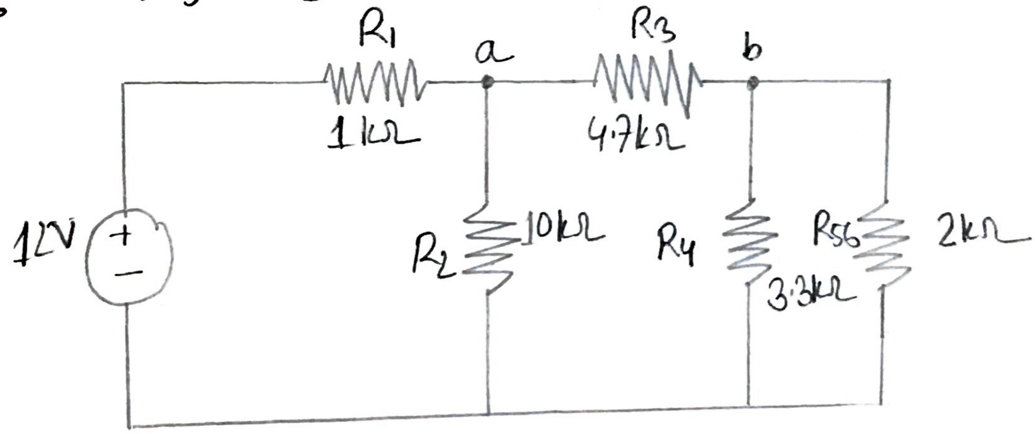
$$\text{Percentage Error} = \frac{|2.409 - 2.44|}{2.44}$$

$$= 0.0127049\ \%$$

For 2ND Circuit,



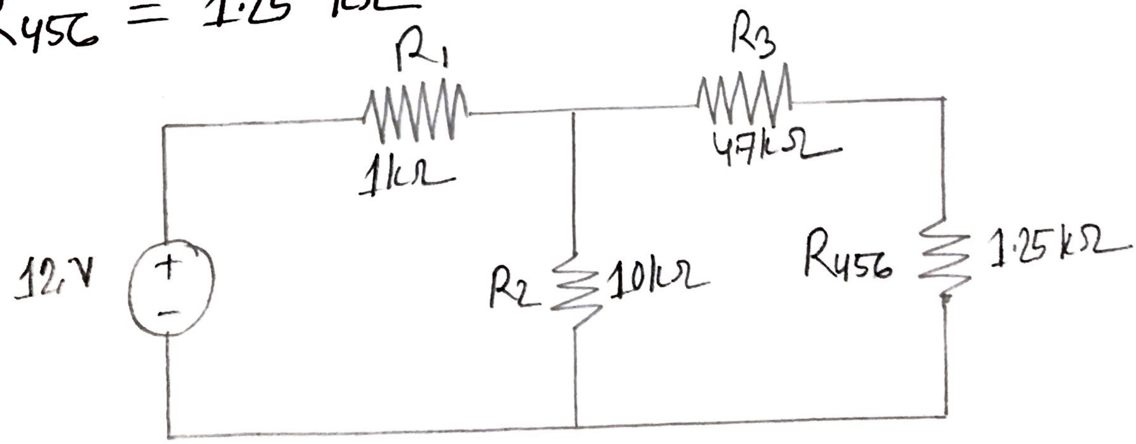
$$R_{56} = R_5 + R_6 = 1+1 = 2\,k\Omega$$



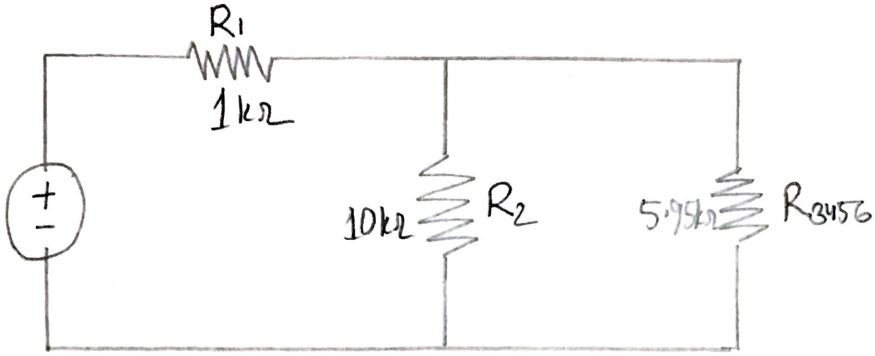
$$\frac{1}{R_{456}} = \frac{1}{R_4} + \frac{1}{R_{56}}$$

$$= \frac{1}{3.3} + \frac{1}{2} = 0.803$$

$$\therefore R_{456} = 1.25\,k\Omega$$



$R_{3456} = R_3 + R_{456} = 4.7 + 1.25 = 5.95 \text{ k}\Omega$



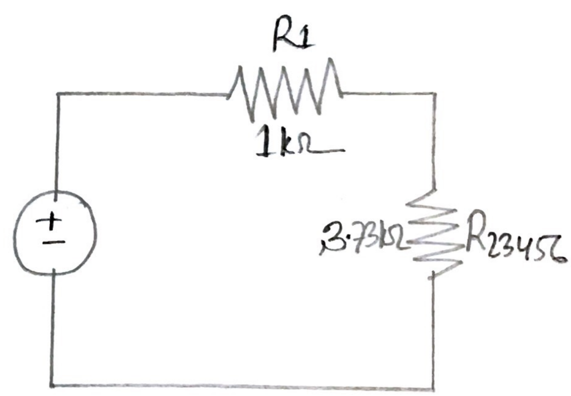
$$\frac{1}{R_{23456}} = \frac{1}{R_2} + \frac{1}{R_{3456}}$$

$$= \frac{1}{10} + \frac{1}{5.95} = 0.27$$

$\therefore R_{23456} = 3.73 \text{ k}\Omega$

$R_{eq} = 1 + 3.73$

$= 4.73 \text{ k}\Omega$



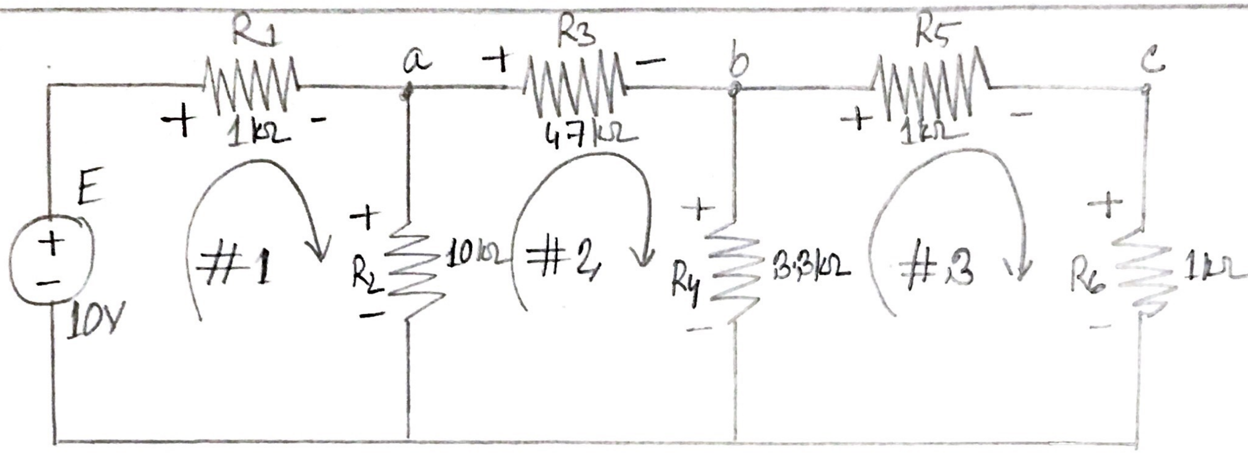
From the experiment we get,

$R_{eq} = 4.67 \text{ k}\Omega$

$$\text{Percentage Error} = \frac{|4.73 - 4.67|}{4.67}$$

$= 0.012847 \%$

4.



Now, For $V_S = 5V$ and $R_{eq} = 4.73\,k\Omega$

$$I_S = \frac{V_S}{R_{eq}} = \frac{5}{4.73} = 1.057\ mA = I_{R1}$$

We have to find all the current flow and voltage.

KCL at node a,

$$I_{R_1} = I_{R_2} + I_{R_3}$$

$$\Rightarrow I_{R_2} + I_{R_3} = 1.057 \quad \text{------ (i)}$$

KCL at node b,

$$I_{R_3} = I_{R_4} + I_{R_5} \quad \text{------ (ii)}$$

KCL at node c,

$$I_{R_5} = I_{R_6} \quad \text{------ (iii)}$$

Ohm's law,

$$V_{R_1} = I_{R_1} \quad \text{----- (iv)}$$

$$V_{R_2} = 10\, I_{R_2} \quad \text{----- (v)}$$

$V_{R3} = 4.7\, I_{R3}$ ------ (vi)

$V_4 = 3.3\, I_{R4}$ ------ (vii)

$V_{R5} = I_{R5}$ ------ (viii)

$V_{R6} = I_{R6}$ ------ (ix)

KVL at loop #1,

$-5 + V_{R1} + V_{R2} = 0$

$\Rightarrow V_{R1} + V_{R2} = 5$

$\Rightarrow I_{R1} + 10\, I_{R2} = 5$

$\Rightarrow 1.057 + 10\, I_{R2} = 5$

$\Rightarrow 10 I_{R2} = 3.943$

$\Rightarrow I_{R2} = 0.3942\ mA$

(i) $\Rightarrow 0.3942 + I_{R3} = 1.057$

$\Rightarrow I_{R3} = 0.6628\, mA$

KVL at loop #2,

$-V_{R2} + V_{R3} + V_{R4} = 0$

$\Rightarrow -10\, I_{R2} + 4.7\, I_{R3} + 3.3\, I_{R4} = 0$

$\Rightarrow -10 \times 0.3942 + 4.7 \times 0.6628 + 3.3\, I_{R4} = 0$

$\Rightarrow 3.3\, I_{R4} = 0.8268$

$\Rightarrow I_{R4} = 0.25\ mA$

(ii) $\Rightarrow 0.6628 = 0.25 + I_{R5}$

$\Rightarrow I_{R5} = 0.4128\ mA$

(iii) $\Rightarrow I_{R6} = 0.4128\ mA$

(iv) $\Rightarrow V_{R1} = 1.057\ V$

(v) $\Rightarrow V_{R2} = 10 \times 0.79$

$= 3.94\ V$

(vi) $\Rightarrow V_{R3} = 4.7 \times 0.6628$

$= 3.12\ V$

(vii) $\Rightarrow V_{R4} = 3.3 \times 0.25$

$= 0.825\ V$

(viii) $V_{R6} = 0.418\ V$

(ix) $V_{R6} = 0.4128\ V$

For Supply voltage $V_s = 10\ V$,

$I_s = \frac{10}{4.73} = 2.11\ mA$

KCL at node a,

$I_{R2} + I_{R3} = 2.11 \quad \text{.....} \text{(i)}$

KCL at node b,

$$I_{R_3} = I_{R_4} + I_{R_5} \quad \text{-----} \quad (ii)$$

KCL at node c,

$$I_{R_5} = I_{R_6} \quad \text{-----} \quad (iii)$$

Ohm's law,

$$V_{R_1} = IR_1 \quad \text{-----} \quad (iv)$$

$$V_{R_2} = 10 I_{R_2} \quad \text{-----} \quad (v)$$

$$V_{R_3} = 4.7\, I_{R_3} \quad \text{-----} \quad (vi)$$

$$V_{R_4} = 3.3\, I_{R_4} \quad \text{-----} \quad (vii)$$

$$V_{R_5} = I_{R_5} \quad \text{-----} \quad (viii)$$

$$V_{R_6} = I_{R_6} \quad \text{-----} \quad (ix)$$

KCL at loop #1

$$-10 + V_{R_1} + V_{R_2} = 0$$

$$\Rightarrow V_{R_1} + V_{R_2} = 10$$

$$\Rightarrow I_{R_1} + 10\, I_{R_2} = 10$$

$$\Rightarrow 2.11 + 10\, I_{R_2} = 10$$

$$\Rightarrow I_{R_2} = 0.79 \text{ mA}$$

$$(i) \Rightarrow 0.79 + I_{R_3} = 2.11$$

$$\Rightarrow I_{R_3} = 1.32 \text{ mA}$$

KVL at loop # 2,

$-V_{R_2} + V_{R_3} + V_{R_4} = 0$

$\Rightarrow -10 I_{R_2} + 4.7 I_{R_3} + 3.3 I_{R_4} = 0$

$\Rightarrow -10 \times 0.79 + 4.7 \times 1.32 + 3 . I_{R_4}$

$\Rightarrow I_{R_4} = 0.51$ mA

(ii) $\Rightarrow 1.32 = 0.51 + I_{R_5}$

$\Rightarrow I_{R_5} = 0.81$ mA

(iii) $\Rightarrow I_{R_6} = 0.81$ mA

(iv) $\Rightarrow V_{R_1} = 2.11$ V

(v) $\Rightarrow V_{R_2} = 7.9$ V

(vi) $\Rightarrow V_{R_3} = 4.7 \times 1.32 = 6.2$ V

(viii) $\Rightarrow V_{R_5} = 0.81$ V

(ix) $\Rightarrow V_{R_6} = 0.81$ V

Again for supply voltage, $V_s = 15$ V

$I_s = \frac{15}{4.73} = 3.17$ mA

KCL at node a,

$I_{R_2} + I_{R_3} = 3.17$ ---- (i)

KCL at node b,

$$I_{R_3} = I_{R_4} + I_{R_5} \quad \text{---- (ii)}$$

KCL at node c,

$$I_{R_5} = I_{R_6} \quad \text{---- (iii)}$$

Ohm's law,

$$V_{R_1} = I_{R_1} \quad \text{------ (iv)}$$

$$V_{R_2} = 10 I_{R_2} \quad \text{------ (v)}$$

$$V_{R_3} = 4.7\, I_{R_3} \quad \text{------ (vi)}$$

$$V_{R_4} = 3.3\, I_{R_4} \quad \text{------ (vii)}$$

$$V_{R_5} = I_{R_5} \quad \text{------ (viii)}$$

$$V_{R_6} = I_{R_6} \quad \text{------ (ix)}$$

KVL at loop #1,

$$V_{R_1} + V_{R_2} = 15$$

$$\Rightarrow 3.17 + 10\, I_{R_2} = 15$$

$$\Rightarrow I_{R_2} = 1.183 \text{ mA}$$

$$\text{(i)} \Rightarrow 1.183 + I_{R_3} = 3.17$$

$$\Rightarrow I_{R_3} = 1.987 \text{ mA}$$

KVL at loop # 2,

$-V_{R_2} + V_{R_3} + V_{R_4} = 0$

$\Rightarrow -10\, I_{R_2} + 4.7 I_{R_3} + 3.3\, I_{R_4} = 0$

$\Rightarrow -10 \times 1.183 + 4.7 \times 1.987 + 3.3\, I_{R_4} = 0$

$\Rightarrow I_{R_4} = 0.755\ mA$

(ii) $\Rightarrow 1.987 = 0.755 + I_{R_5}$

$\Rightarrow I_{R_5} = 1.232\ mA$

(iii) $\Rightarrow I_{R_6} = 1.232\ mA$

(iv) $\Rightarrow V_{R_1} = 3.17\ V$

(v) $\Rightarrow V_{R_2} = 11.83\ V$

(vi) $\Rightarrow V_{R_3} = 9.34\ V$

(vii) $\Rightarrow V_{R_4} = 2.49\ V$

(viii) $\Rightarrow V_{R_5} = 1.232\ V$

(ix) $\Rightarrow V_{R_6} = 1.232\ V$

5. For supply voltage 5V, We got

$V_S = 4.97$ V, $V_{R_1} = 1.049$ V

$V_{R_2} = 3.92$ V

$V_{R_3} = 3.10$ V

$V_{R_4} = 0.818$ V

$V_{R_5} = 0.402$ V

$V_{R_6} = 0.415$ V

KVL at loop-1

$V_{R_1} + V_{R_2} = 4.97$

$\Rightarrow 4.969 \approx 4.97$

KVL at loop-2

$-V_{R_2} + V_{R_3} + V_{R_4} = 0$

$\Rightarrow -3.92 + 3.10 + 0.818$

$\Rightarrow -0.002 \approx 0$

KVL at loop-3

$-V_4 + V_{R_5} + V_{R_6} = 0$

$\Rightarrow -0.818 + 0.402 + 0.415 = 0$

$\Rightarrow -0.001 \approx 0$

Ans. From experiment, For supply voltage 10V, we got,

$V_S = 9.99\ V$

$V_{R_1} = 2.09\ V$

$V_{R_2} = 7.92\ V$

$V_{R_3} = 6.28\ V$

$V_{R_4} = 1.63\ V$

$V_{R_5} = 0.82\ V$

$V_{R_6} = 0.81\ V$

according to KVL at loop - 1

$V_{R_1} + V_{R_2} = 9.99$

$\Rightarrow 2.09 + 7.92 = 9.99$

$\therefore 10.01 \approx 9.99$

KVL at loop - 2

$-V_{R_2} + V_{R_3} + V_{R_4} = 0$

$\Rightarrow -7.92 + 6.28 + 1.63 = 0$

$\Rightarrow -0.01 \approx 0$

KVL at loop - 3

$-V_{R_4} + V_{R_5} + V_{R_6}$

$\Rightarrow -1.63 + 0.82 + 0.81$

$\Rightarrow 0 = 0$

For supply voltage 15 V,

$V_S = 14.98$ V

$V_{R_1} = 3.116$ V

$V_{R_2} = 11.82$ V

$V_{R3} = 9.35$ V

$V_{R4} = 2.472$ V

$V_{R5} = 1.217$ V

$V_6 = 1.254$ V

KVL at loop-1,

$V_{R_1} + V_{R_2} = 14.98$

$\Rightarrow 3.116 + 11.82 = 14.98$

$\Rightarrow 14.936 \approx 14.98$

KVL at loop-2,

$-V_{R_2} + V_{R_3} + V_{R4}$

$\Rightarrow -11.82 + 9.35 + 2.472 = 0$

$\Rightarrow 0.002 \approx 0$

KVL at loop - 3,

$$-V_{R_4} + V_{R_5} + V_{R_6} = 0$$

$$\Rightarrow -2.472 + 1.217 + 1.254 = 0$$

$$\Rightarrow -0.001 \approx 0$$

So, we can say that, Kirchhoff's voltage law within each independent closed loop of the circuit from the experimental data are verified.

6. From experiment for voltage supply 5V, we got,

$I_S = I_{R_1} = 1.057$

$I_{R_2} = 0.3942$ mA

$I_{R_3} = 0.6628$ mA

$I_{R_4} = 0.25$ mA

$I_{R_5} = 0.4128$ mA

$I_{R_6} = 0.4128$ mA

KCL at node a,

$I_{R_1} = I_{R_2} + I_{R_3}$

$\Rightarrow 1.057 = 1.057$

KCL at node b,

$I_{R_3} = I_{R_4} + I_{R_5}$

$\Rightarrow 0.6628 = 0.25 + 0.4128$

$\Rightarrow 0.6628 = 0.6628$

For Supply voltage 10 V, we got,

$I_S = I_{R_1} = 2.11$ mA

$I_{R_2} = 0.79$ mA

$I_{R_3} = 1.32$ mA

$I_{R_4} = 0.51$ mA

$I_{R_5} = 0.81$ mA

$I_{R_6} = 0.81$ mA

KCL at node a,

$I_{R_1} = I_{R_2} + I_{R_3}$

$\Rightarrow 2.11 = 0.79 + 1.32$

$\Rightarrow 2.11 = 2.11$

KCL at node b,

$I_{R_3} = I_{R_4} + I_{R_5}$

$\Rightarrow 1.32 = 0.51 + 0.81$

$\Rightarrow 1.32 = 1.32$

And, for supply voltage 15v, we got,

$I_s = I_{R_1} = 3.17$

$I_{R_2} = 1.183$ mA

$I_{R_3} = 1.987$ mA

$I_{R_4} = 0.755$ mA

$I_{R_5} = 1.232$ mA

$I_{R_6} = 1.232$ mA

KCL at node a,

$$I_{R_1} = I_{R_2} + I_{R_3}$$

$$\Rightarrow 3.17 = 1.183 + 1.987$$

$$\Rightarrow 3.17 = 3.17$$

KCL at node b,

$$I_{R_3} = I_{R_4} + I_{R_5}$$

$$\Rightarrow 1.987 = 0.755 + 1.232$$

$$\Rightarrow 1.987 = 1.987$$

So, Kirchhoff's current law at node a and b of the current from data is verified.

Result Analysis and Discussion:

In this experiment we build two circuit. 1ST one is rather simple circuit than the other one.

For the first circuit, we have four resistors. First three resistors are connected parallely and the last one is connected in series with them. Given resistors are 3.3 kΩ, 4.7 kΩ, 5.6 kΩ, and 1 kΩ. Parallel resistors can be built on same node on three different node. Parallely connected resistor have same voltage but different current flow. We were find voltage difference for each and equivalent resistors. For measure equivalent on each resistance, we were disconnect the circuit from source.

Second Circuit is compairly a complex circuit, with six resistors. We were build the circuit on board same as the diagram find theoretically, we use KCL, KVL, Ohm's law, current - voltage division rule etc. After applying KCL on first circuit, we see that our practical data comparably match with theoretical data. So we say that, our circuit follow KCL. Then we were find percentage of error and % error can not be negative. To avoid negativity, we were use modulus. Theoretical and practical value are very close. So, the percentage of error is not very high.

Conclusion :

After completing this experiment, we got to know how to build a ladder circuit in a bread board. To complete this experiment we need to use Ohm's law, KVL, KCL, Current division rule, equivalent resistance rule with other mathematical terms. We got to know about how to measure voltage, current and resistor by DMM, and verify KVL, KCL and how to calculate percentage of error.

Table-1

	Experimental readings			
V/s(volt)	V/s(volt)	V1 (volt)	V_2, (volt)	V_3 (volt)
5 ~~V~~	~~[illegible]~~ 4.98	2.04	~~2.118~~ 2.92	~~2.118~~ 2.92
10	~~4.11~~ 9.97	4.11	5.88	5.88
15	~~6.18~~ 15.01	6.18	8.85	8.885

Table-2

Experimental Req(kΩ)	Theoretical Req(kΩ)	% Error
2.409	2.44	0.0127049 %

Table-3

	Experimental readings (Voltage)						
E	E	R_1	R_2	R_3	R_4	R_5	R_6
5	4.97	1.049	3.92	3.10	0.818	0.402	0.415
10	~~10.03~~ 9.99	2.09[illegible]	7.92	6.28	1.69[illegible]	0.81[illegible]	0.81[illegible]
15	14.98	3.166	11.82	9.35	2.472	1.217	1.254

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Table-4

Experimental Req, (kΩ)	Theoretical Req, (kΩ)	% Error
~~4.67~~ 4.73	~~4.728~~ 4.67	0.012847%