CSE 250

Lab-02

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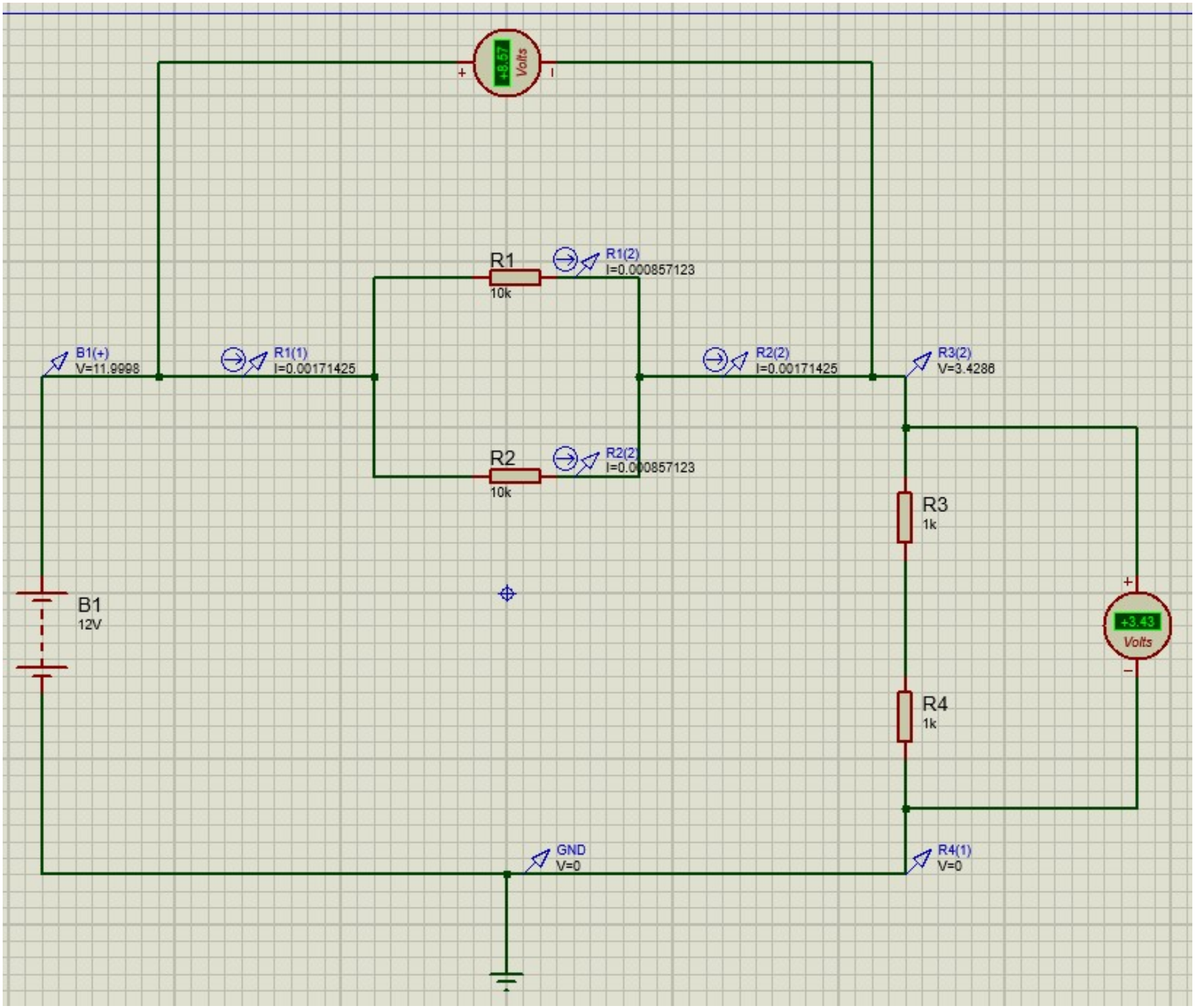
Experiment 2:

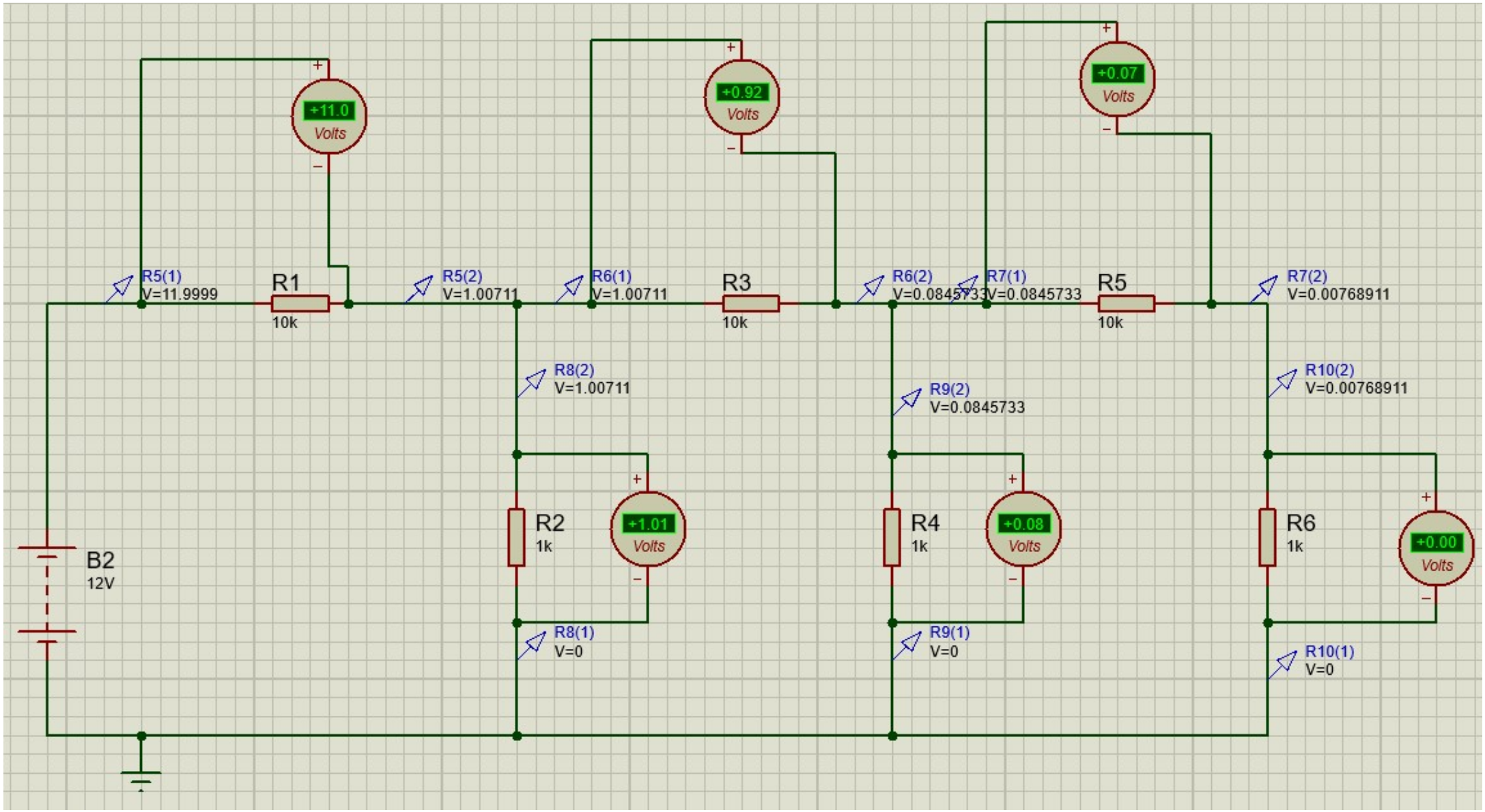
Name of the experiment: Introduction to series and parallel circuits

Objective: The experiment is to acquaint the students with series-parallel circuits and to give them the idea about how to connect different circuits in breadboard.

Apparatus: DC voltage source, resistors, multimeter

Procedure:


+8.57
Volts
R1
10k
R1(2)
I=0.000857123
B1(+)
V=11.9998
R1(1)
I=0.00171425
R2(2)
I=0.00171425
R3(2)
V=3.4286
R2
10k
R2(2)
I=0.000857123
R3
1k
B1
12V
+3.43
Volts
R4
1k
GND
V=0
R4(1)
V=0


+11.0
Volts
+0.92
Volts
+0.07
Volts
R5(1)
V=11.9999
R1
10k
R5(2)
V=1.00711
R6(1)
V=1.00711
R3
10k
R6(2)
V=0.0845733
R7(1)
V=0.0845733
R5
10k
R7(2)
V=0.00768911
R8(2)
V=1.00711
R9(2)
V=0.0845733
R10(2)
V=0.00768911
R2
1k
+1.01
Volts
R4
1k
+0.08
Volts
R6
1k
+0.00
Volts
B2
12V
R8(1)
V=0
R9(1)
V=0
R10(1)
V=0

Reports:

For circuit 1:

$V = 12V$
$R_1 = 10K\Omega$
$R_2 = 10K\Omega$
$R_3 = 1K\Omega$
$R_4 = 1K\Omega$

V_1	V_2	$V_1+V_2=V$	I_1	I_2	$I_1+I_2=I$
8.57V	3.43V	12V	857123×10^{-9}	857123×10^{-9}	1714246×10^{-9}

For circuit 2:

V = 12V
R1 = 10K-Ω = 10000 ohm
R2 = 1K-Ω = 1000 ohm
R3 = 10K-Ω = 10000 ohm
R4 = 1K-Ω = 1000 ohm
R5 = 10K-Ω = 10000 ohm
R6 = 1K-Ω = 1000 ohm

V1	V2	V3	V4	V5	V6	I1(A)	I2(A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)
11V	1.01	0.92	0.08	0.07	0.007	1.1×10^{-3}	1.0×10^{-3}	92×10^{-6}	80×10^{-6}	7×10^{-6}	7×10^{-6}

One of the discrepancies are that from the circuit, the value measured using multimeter is 13.087V but initially the value of the DC cell source is 12V. This happened during the partial errors during the calculation.

Question:

1. The instruments using in circuit 1 are:

$V = 12V$

$R_1 = 10K\Omega$

$R_2 = 10K\Omega$

$R_3 = 1K\Omega$

$R_4 = 1K\Omega$

$$R_P = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$$

$$= (1/5)^{-1} K\Omega = 5K\Omega$$

$$R_{eq} = R_P + R_3 + R_4$$

$$= 5 + 1 + 1 = 7K\Omega = 7000 \text{ ohm}$$

$$I = \frac{V}{R}$$

$$= \frac{12}{7000} = 1714285714 \times 10^{-12} A$$

The instrument used in circuit-2:

$R_1 = 10K\Omega$
$R_2 = 1K\Omega$
$R_3 = 10K\Omega$
$R_4 = 1K\Omega$
$R_5 = 10K\Omega$
$R_6 = 1K\Omega$
$V = 12V$

$$R_{Pa} = (R_5 + R_6)$$

$$= 11K\Omega$$

$$R_{Pb} = \left(\frac{1}{R_{Pa}} + \frac{1}{R_4}\right)^{-1}$$

$$= 11/12\ K\Omega$$

$$R_{Pc} = (R_3 + R_{Pb})$$

$$= 10 + 11/12 = \frac{131}{12}$$

$$R_{Pd} = \left(\frac{1}{R_{Pc}} + \frac{1}{R_2}\right)^{-1}$$

$$= \left(\frac{12}{131} + 1\right)^{-1}$$

$$= \frac{131}{143}\ K\Omega$$

$$R_{eq} = (R_1 + R_{Pd})\ K\Omega$$

$$= \left(10 + \frac{131}{143}\right) K\Omega$$

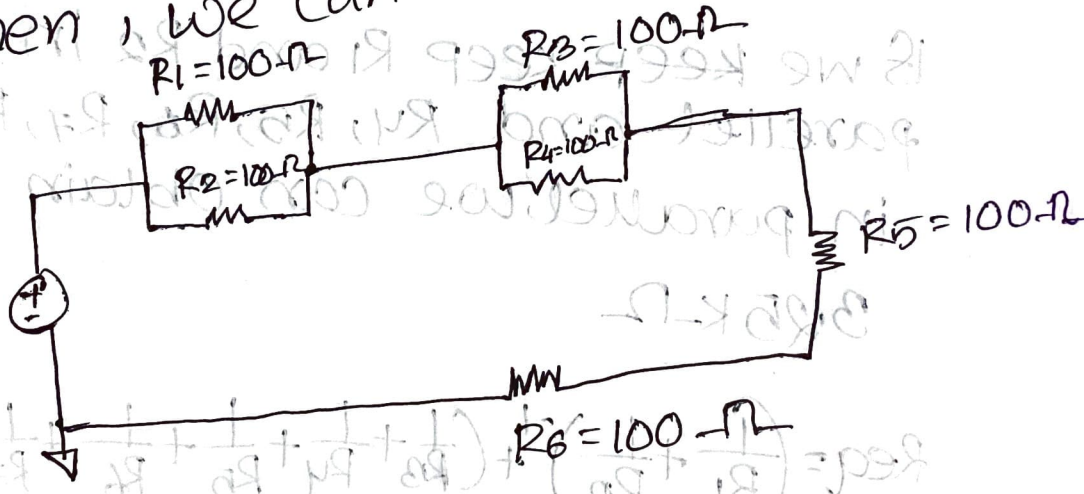
$$= \frac{1561}{143}\ K\Omega = 10916.08392\ \Omega$$

$$I = \frac{V}{R_{eq}} = \frac{12}{10916.08392}\ A$$

$$= 1.099\,295\,32.3 \times 10^{-3}\ A$$

By calculating, the current ~~ment~~ calculated by ohm's law which is $V=IR$ is similar to values obtained by the multimeter in the circuit.

2. If we keep 4 resistors in parallel, then, we can have 300 ohm.



$$R_{eq} = \left(\frac{1}{R_1}+\frac{1}{R_2}\right)^{-1} + \left(\frac{1}{R_3}+\frac{1}{R_4}\right)^{-1} + R_5 + R_6$$

$$= \left(\frac{1}{50}\right)^{-1} + \left(\frac{1}{50}\right)^{-1} + 100 + 100$$

$$= 300\,\Omega$$

3.

Given,

$R_1 = 1.5K\Omega$
$R_2 = 1.5K\Omega$
$R_3 = 15K\Omega$
$R_4 = 15K\Omega$
$R_5 = 15K\Omega$
$R_6 = 15K\Omega$
$R_7 = 15K\Omega$
$R_8 = 15K\Omega$

If we ~~keer~~ keep R_1 and R_2 in parellel and R_4, R_5, R_6, R_7, R_8 in parallel, we can obtain

$3.25K\Omega$

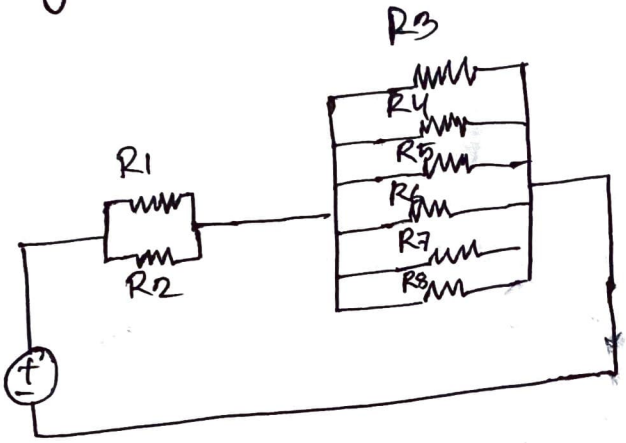
$$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1} + \left(\frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6} + \frac{1}{R_7} + \frac{1}{R_8}\right)^{-1}$$

$$= \left(\frac{1}{1.5} + \frac{1}{1.5}\right)^{-1} + \left(\frac{1}{15} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15}\right)^{-1}$$

$$= 3/4 + 5/2 = 13/4\ K\Omega$$

$$= 3.25K\Omega$$

Figure:



Discussion: After the completion of the experiment, we get to learn the physical application of ohm's law and the devices to create the circuit. It shows us how to determine and measure the value of current, resistance and voltage.