CSE250

CIRCUITS AND ELECTRONICS

EXPERIMENT NO. : 02

EXPERIMENT NAME : INTRODUCTION TO SERIES AND PARALLEL CIRCUITS

SHAIANE PREMA BAROI

ID: 21101098

SECTION: 07

1> 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 bread board.

2> Apparatus

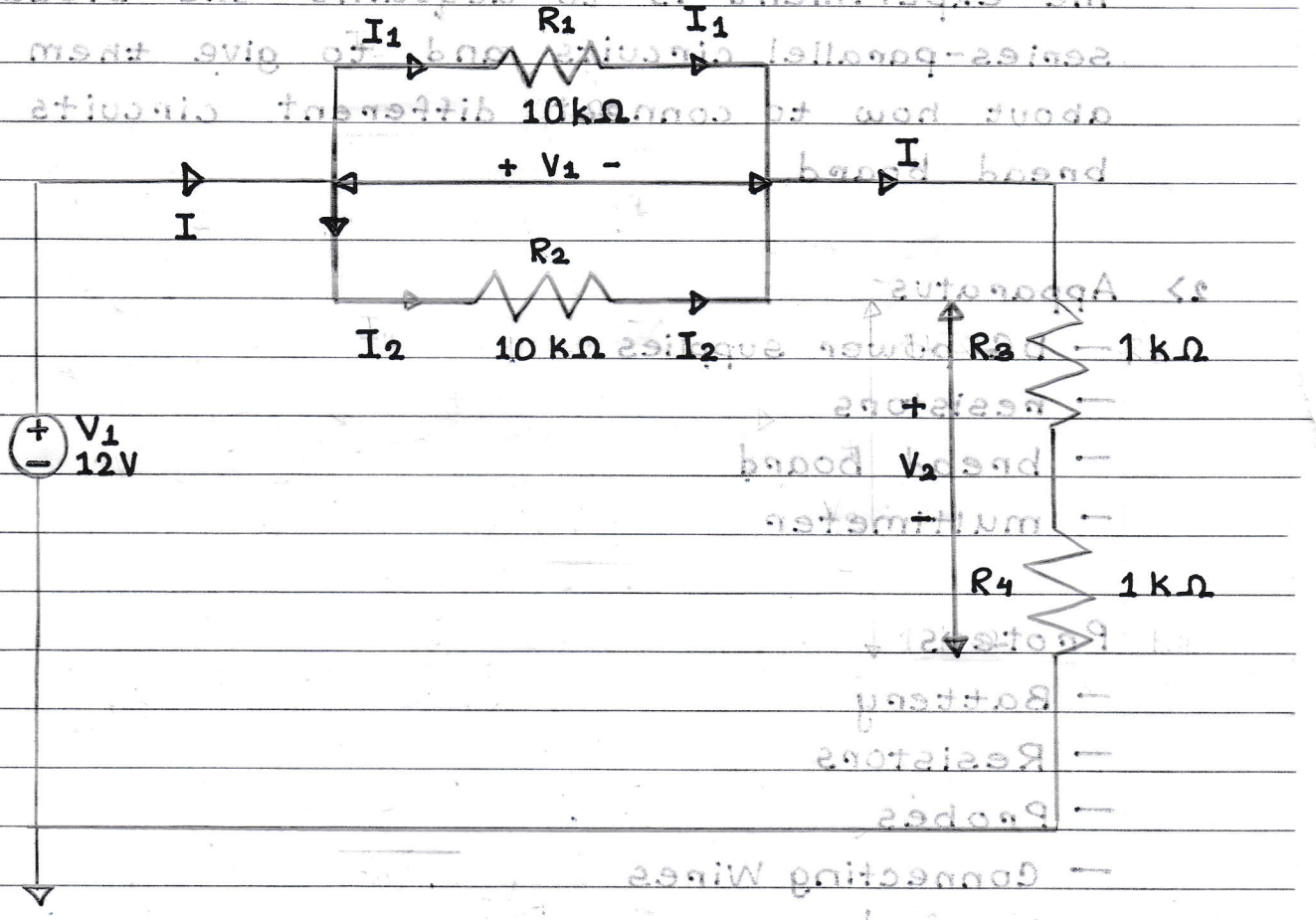
- DC power supplies
- resistors
- bread board
- multimeter

Proteus

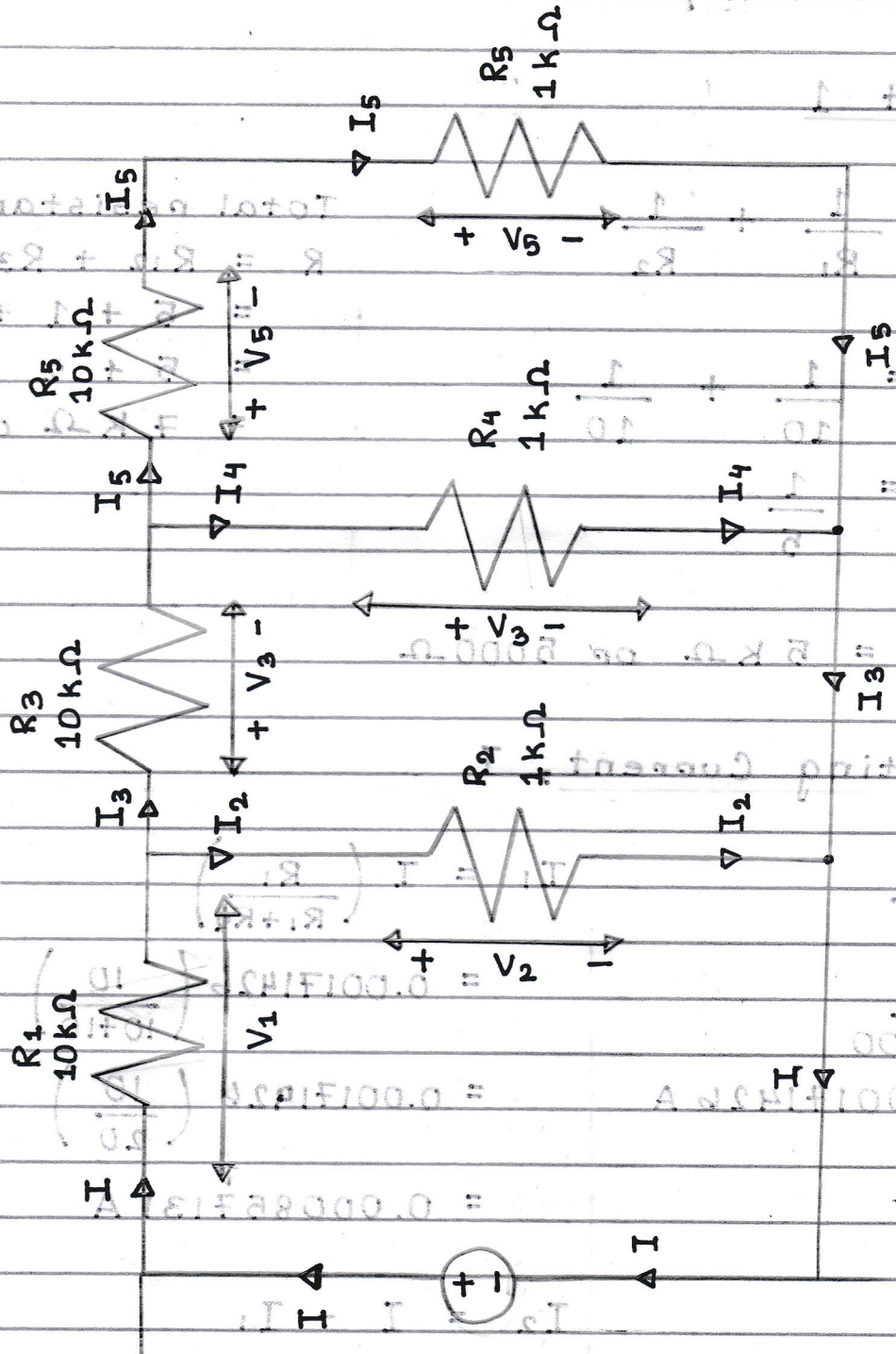
- Battery
- Resistors
- Probes
- Connecting Wires
- Ground

3> Circuit / Block / System Diagram

(a)



(b)


R5 1kΩ
I5
+ V5 −
R5 10kΩ
R4 1kΩ
I4
+ V3 −
R3 10kΩ
I3
R2 1kΩ
I2
+ V2 −
R1 10kΩ
V1
I
I1

4> Results / Analysis

(a) Circuit 1

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\Rightarrow \frac{1}{R_{12}} = \frac{1}{10} + \frac{1}{10}$$

$$\Rightarrow \frac{1}{R_{12}} = \frac{1}{5}$$

$$\therefore R_{12} = 5\ k\Omega \text{ or } 5000\ \Omega$$

Total resistance

$$R = R_{12} + R_3 + R_4$$
$$= 5 + 1 + 1$$
$$= 5 + 2$$
$$= 7\ k\Omega \text{ or } 7000\ \Omega$$

Calculating Current

$$I = \frac{V}{R}$$
$$= \frac{12}{7000}$$
$$= 0.00171426\ A$$

$$I_1 = I\left(\frac{R_1}{R_1+R_2}\right)$$
$$= 0.00171426\left(\frac{10}{10+10}\right)$$
$$= 0.00171926\left(\frac{10}{20}\right)$$
$$= 0.000857131\ A$$

$$I_2 = I - I_1$$
$$= 0.00171426 - 0.000857131$$
$$= 0.000857131\ A$$

Calculating Voltage (d)

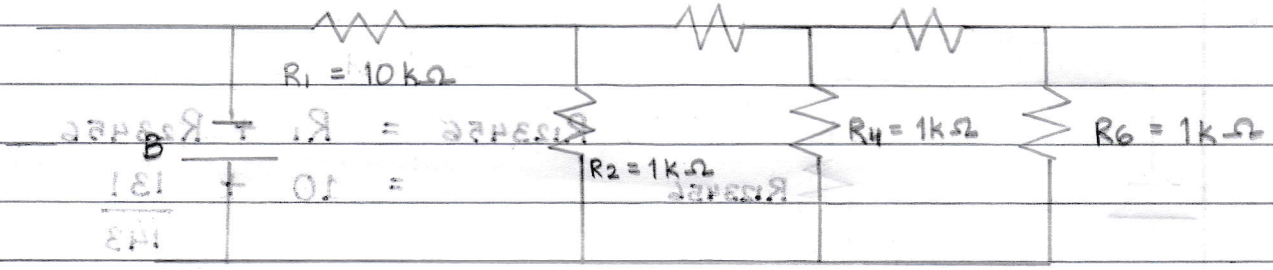
$$V = IR$$
$$\Rightarrow V_2 = I\,(R_3 + R_4)$$
$$\Rightarrow V_2 = 0.00171426\,(1000 + 1000)$$
$$\therefore V_2 = 3.42852\ V$$

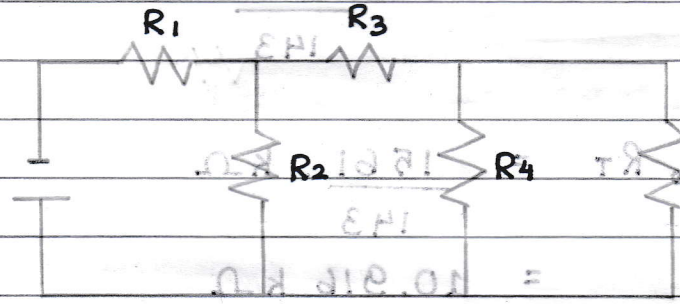
Results

CURRENT			VOLTAGE		
I_1	I_1	I_2	V_S	V_1	V_2
0.00171426	0.000857131	0.000857131	12	12	3.42852

(b) Circuit 2

Calculating Total Resistance, R_T

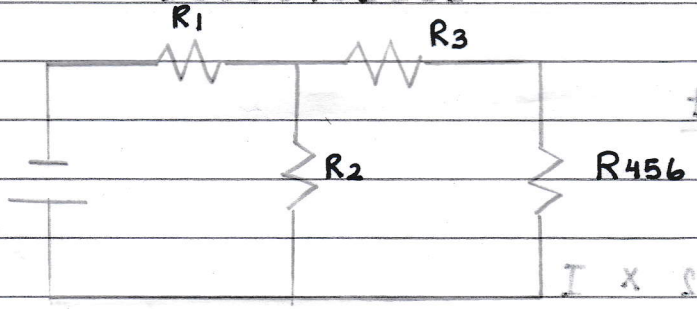




$R_{56} = R_5 + R_6$

$= 10\,k\Omega + 1\,k\Omega$

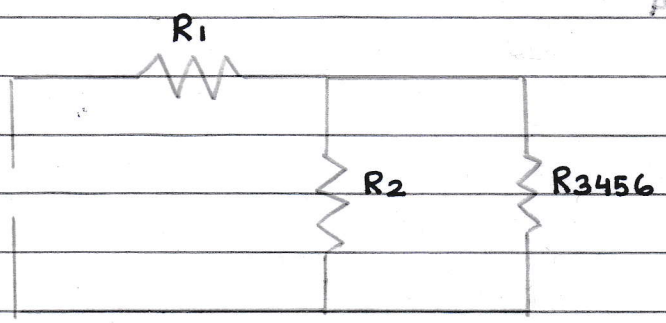
$= 11\,k\Omega$



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

$\Rightarrow \frac{1}{R_{456}} = \frac{1}{1} + \frac{1}{11}$

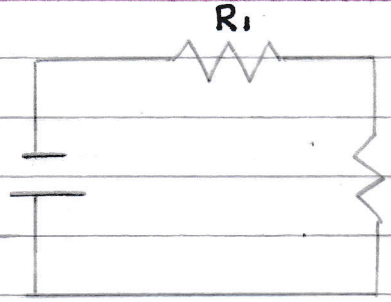
$\therefore R_{456} = \frac{11}{12}\,k\Omega$



$R_{3456} = R_3 + R_{456}$

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

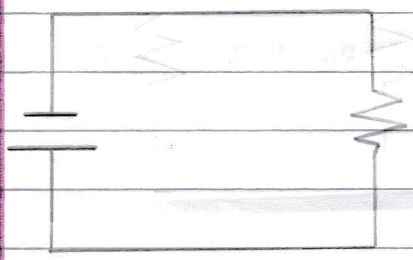
$= \frac{131}{12}\,k\Omega$



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

$$\Rightarrow \frac{1}{R_{23456}} = \frac{1}{1} + \frac{1}{\frac{131}{12}}$$

$$\therefore R_{23456} = \frac{131}{143}\ k\Omega$$



$$R_{123456} = R_1 + R_{23456}$$

$$= 10 + \frac{131}{143}$$

$$= \frac{1561}{143}\ k\Omega$$

$$\therefore \text{Total resistance, } R_T = \frac{1561}{143}\ k\Omega$$

$$= 10.916$$

$$= 10916.08392\ \Omega$$

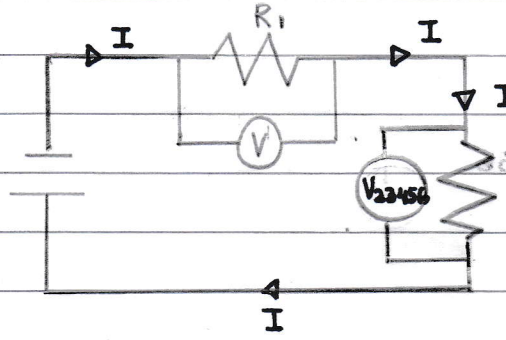
Calculating Current

$$V = IR$$

$$\Rightarrow 12 = 10916.08392 \times I$$

$$\therefore I = 1.099295\text{mA}$$

$$= 1.10\text{mA}$$



$V_1 = I R_1$

$\Rightarrow V_1 = 1.099295\,mA \times 10\,k\Omega$

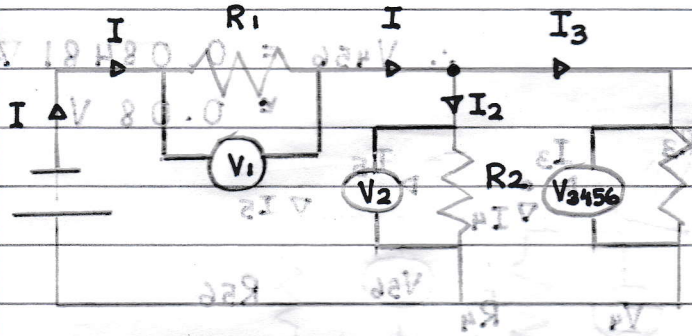
$\therefore V_1 = 10.99\,V$

$\therefore \underline{V_1 \approx 11\,V}$

$V_{23456} = 12 - V_1$

$= 12 - 10.99$

$= 1.01\,V$



$V_{23456} = V_2 = V_{3456} = 1.01\,V$

$\therefore \underline{V_2 = 1.01\,V}$

$V = IR$

$\Rightarrow V_2 = I_2 R_2$

$\Rightarrow 1.01 = I_2 (1)$

$\therefore \underline{I_2 = 1.01\,mA}$

$V = IR$

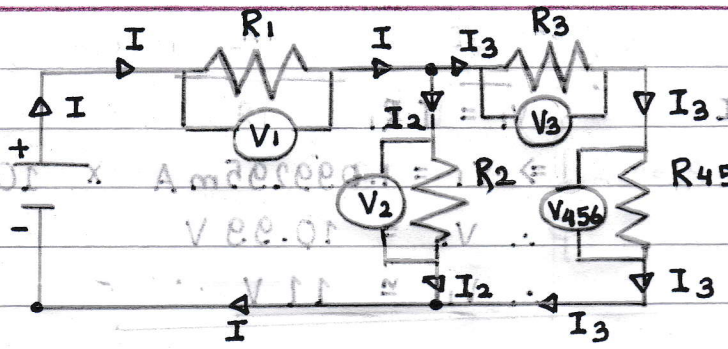
$\Rightarrow V_{3456} = I_3 R_{3456}$

$\Rightarrow 1.01 = I_3 \left(\frac{131}{12} \times 1000\right)$

$\therefore I_3 = 9.2519084 \times 10^{-5}\,A$

$= 0.09252\,mA$

$\therefore \underline{I_3 \approx 0.09\,mA}$



$V_3 = IR$

$\Rightarrow V_3 = I_3 R_3$

$\Rightarrow V_3 = 0.09252\ mA \times 10\ k\Omega$

$\therefore V_3 = 0.92\ V$

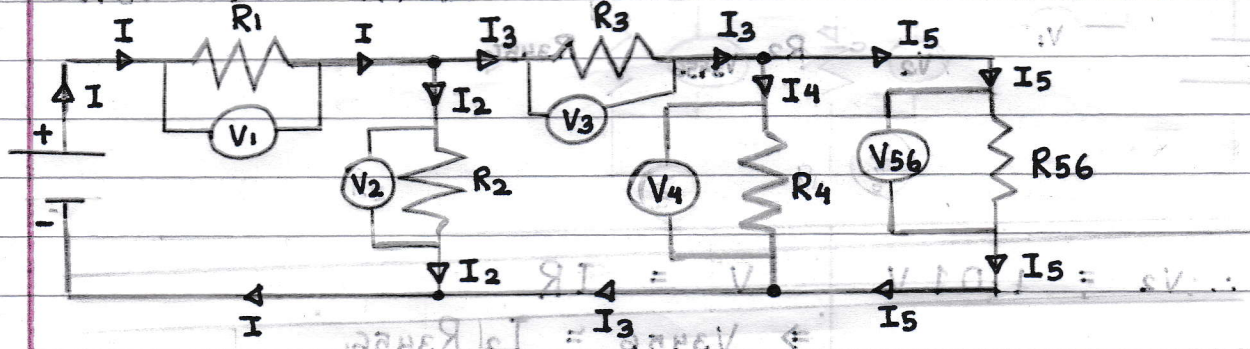
$V = IR$

$\Rightarrow V_{456} = I_3 R_{456}$

$\Rightarrow V_{456} = 0.09252 \times \frac{11}{12}$

$\therefore V_{456} = 0.08481\ V$

$\approx 0.08\ V$



$V_4 = V_{56} = V_{456} = 0.08\ V$

$V = IR$

$\Rightarrow V_4 = I_4 R_4$

$\Rightarrow 0.08 = I_4 (1 \times 1000)$

$\therefore I_4 = 8 \times 10^{-5}\ A$

$\therefore I_4 = 0.08\ mA$

$V = IR$

$\Rightarrow V_{56} = I_5 R_{56}$

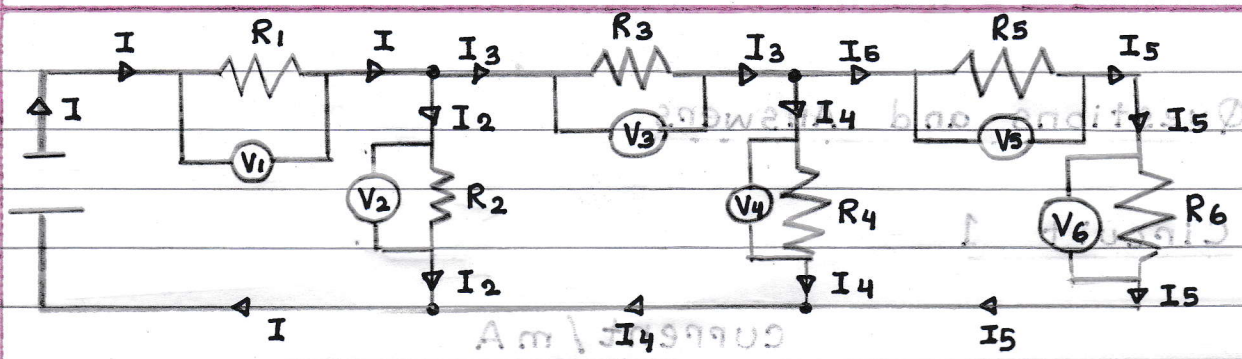
$\Rightarrow 0.08491 = I_5 \times 11 \times 1000$

$\therefore I_5 = 7.7099 \times 10^{-6}\ A$

$= 7.7099 \times 10^{-3}\ mA$

$= 0.07$

$\therefore I_5 \approx 7.69\ \mu A$



$V_5 = I_5 R_5$

$= 7.69 \times 10^{-3}\ mA \times 10\ k\Omega$

$\therefore V_5 = 0.0769\ V$

$V_6 = I_5 R_6$

$= 7.69 \times 10^{-3}\ mA \times 1\ k\Omega$

$\therefore V_6 = 7.69 \times 10^{-3}\ V$

Results

current / mA					voltage / V					
I	I_2	I_3	I_4	I_5	$I_6 V_1$	V_2	V_3	V_4	V_5	V_6
1.10	1.01	0.09	0.08	7.69×10^{-3}	11	1.01	0.92	0.08	0.0769	7.69×10^{-3}

5> Questions and Answers

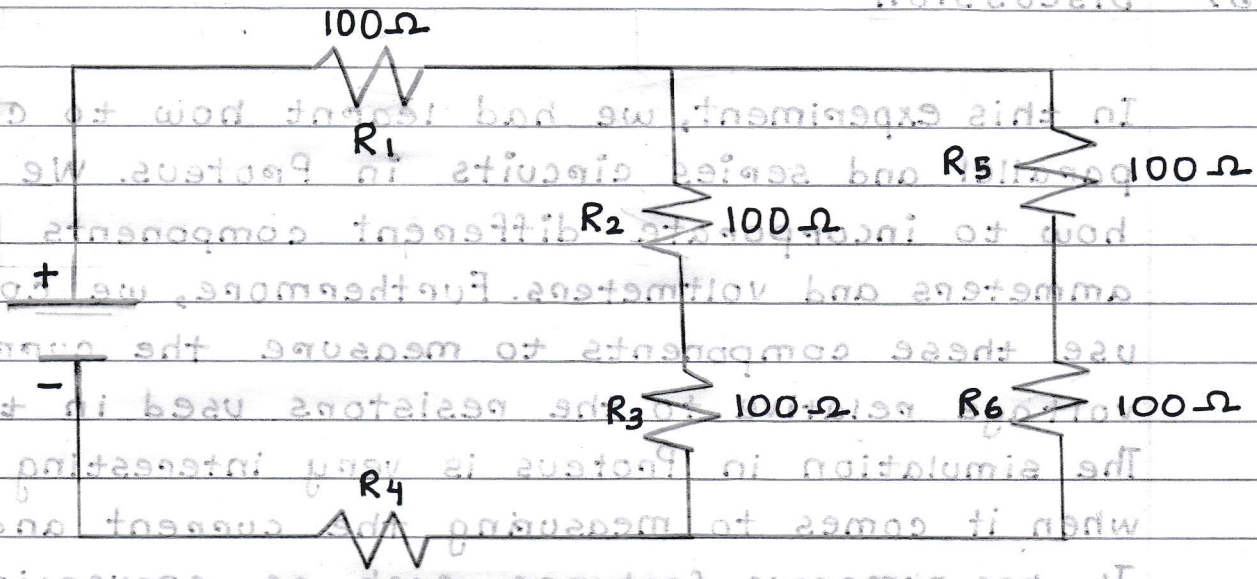
1> a> Circuit 1

current / mA		
I	I_1	I_2
1.7143	0.8571	0.8571

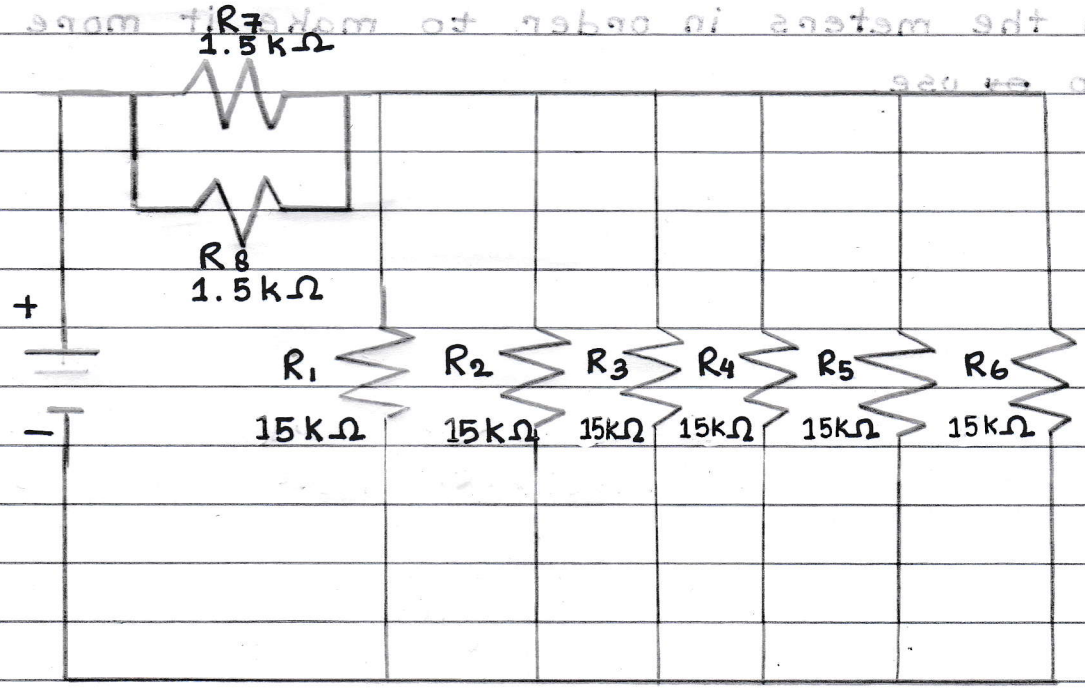
b> Circuit 2

current / mA				
I	I_2	I_3	I_4	I_5
1.01	1.01	0.09	0.08	7.69×10^{-3}

4>


100Ω
R1
R5
100Ω
R2
100Ω
+
−
R3
100Ω
R6
100Ω
R4

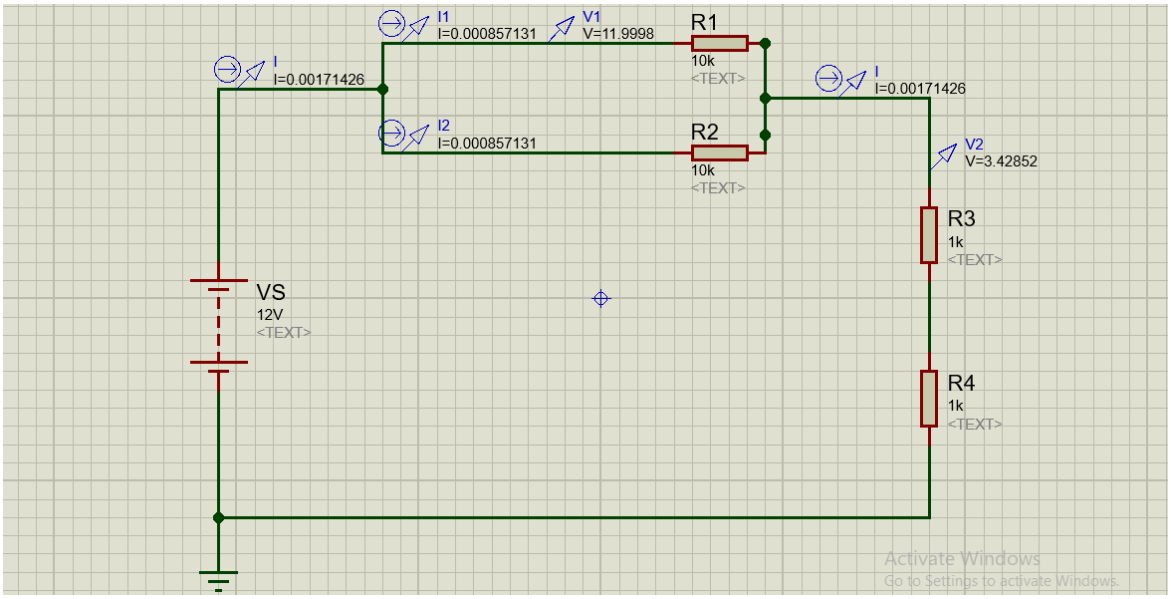
5>


R7
1.5kΩ
R8
1.5kΩ
+
−
R1
15kΩ
R2
15kΩ
R3
15kΩ
R4
15kΩ
R5
15kΩ
R6
15kΩ

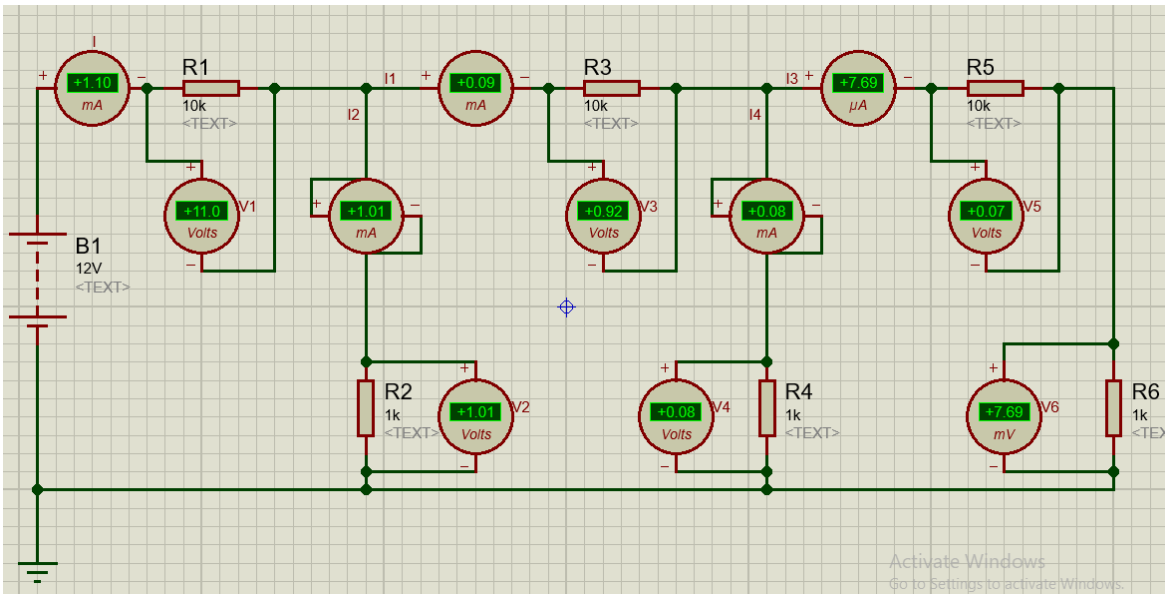
6> Discussion

In this experiment, we had learnt how to construct parallel and series circuits in Proteus. We learnt how to incorporate different components such as ammeters and voltmeters. Furthermore, we could also use these components to measure the current and voltage relative to the resistors used in the circuit. The simulation in Proteus is very interesting and helpful when it comes to measuring the current and voltage. It has numerous features such as conversion to units in the meters in order to make it more convenient to ~~or~~ use.

(a)


I1
I=0.000857131
V1
V=11.9998
R1
10k
<TEXT>
I
I=0.00171426
I2
I=0.000857131
R2
10k
<TEXT>
I
I=0.00171426
V2
V=3.42852
R3
1k
<TEXT>
VS
12V
<TEXT>
R4
1k
<TEXT>
Activate Windows
Go to Settings to activate Windows.

(b)


I
+1.10
mA
R1
10k
<TEXT>
I1
+0.09
mA
R3
10k
<TEXT>
I3
+7.69
µA
R5
10k
<TEXT>
+11.0
Volts
V1
I2
+1.01
mA
+0.92
Volts
V3
I4
+0.08
mA
+0.07
Volts
V5
B1
12V
<TEXT>
R2
1k
<TEXT>
+1.01
Volts
V2
+0.08
Volts
V4
R4
1k
<TEXT>
+7.69
mV
V6
R6
1k
Activate Windows
Go to Settings to activate Windows.