BRAC UNIVERSITY

CSE250: Circuits and Electronics Laboratory

Experiment No : 2

Student Name : Eftykhar Rahman

ID : 18301041

Section : 20

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 bread board.

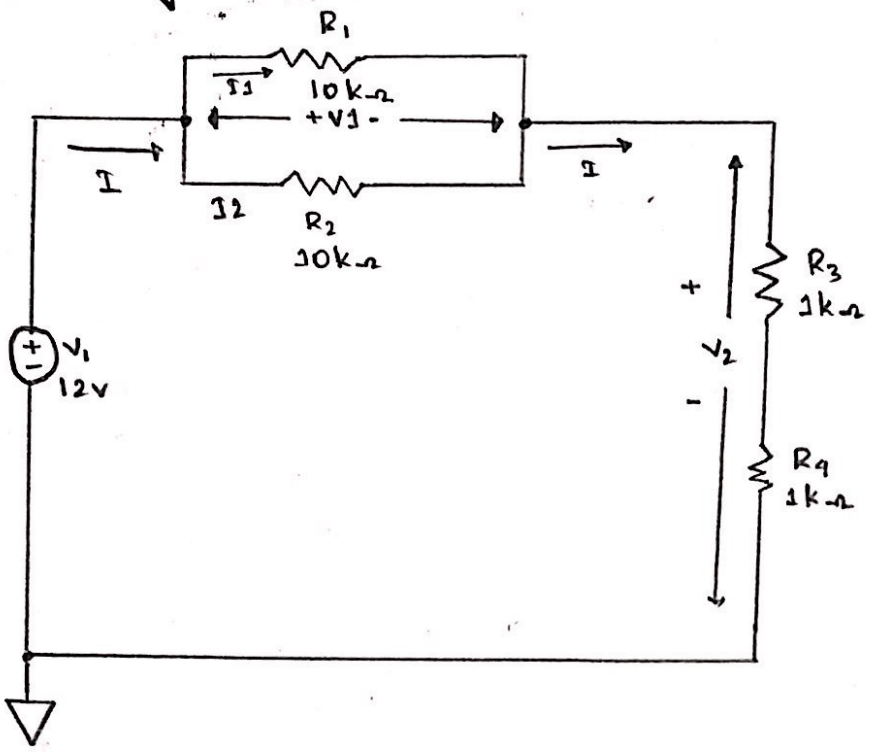
Apparatus : DC power supplies

Resistors

Bread Board / Trainer Board

Multimeter

Circuit Diagram :



Result :

Here, R_1 and R_2 resistors are in parallel and R_3 and R_4 resistors are in series circuit system.

So, the value of $R_{12} = \frac{1}{\frac{1}{10} + \frac{1}{10}} k\Omega = 5\,k\Omega$

and the value of $R_{34} = (1+1)\,k\Omega = 2\,k\Omega$

Thus the valve of $R_{1234} = (5+2)\,k\Omega = 7\,k\Omega$; as R_{12} and R_{34} are in series.

Now, $V = 12\,V$

$$\therefore I = \frac{V}{R} = \frac{12\,V}{7k\Omega} = 1.714 \times 10^{-3}\,A$$

Again,

$R_3 = 1\,k\Omega$

$I_3 = 1.714 \times 10^{-3}\,A$

$V_3 = I_3 \times R_3 = 1.714 \times 10^{-3}\,A \times 1 \times 10^{3}\,\Omega = 1.714\,V$

$R_4 = 1\,k\Omega$

$I_4 = 1.714 \times 10^{-3}\,A$

$V_4 = I_4 \times R_4 = 1.714 \times 10^{-3}\,A \times 1 \times 10^{3}\,\Omega = 1.714\,V$

As R_3 and R_4 are in series and we know that in series configuration voltage get divided and same current flows.

Moreover, R_1 and R_2 are in parallel configuration so current gets divided and voltage remain same.

$R_1 = 10\,k\Omega$

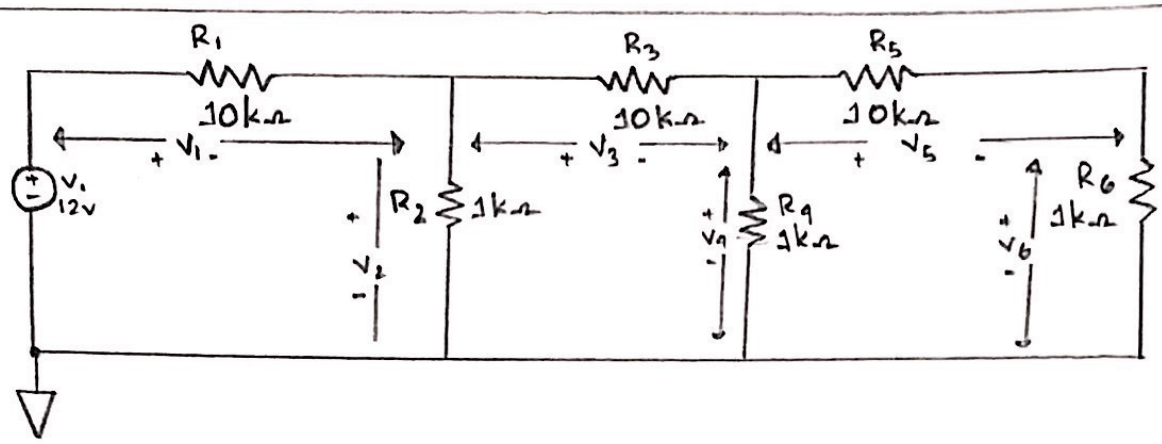
$V_1 = (12 - 3.429)V = 8.571\,V$

$I_1 = \frac{8.571}{10 \times 10^{3}} = 8.571 \times 10^{-4}\,A$

$R_2 = 10\,k\Omega$

$V_2 = 8.571\,V$

$I_2 = \frac{8.571}{10 \times 10^{3}} = 8.571 \times 10^{-4}\,A$



Here, $R_1 = 10\,k\Omega$

$R_2 = 1\,k\Omega$

$R_3 = 10\,k\Omega$

$R_4 = 1\,k\Omega$

$R_5 = 10\,k\Omega$

$R_6 = 1\,k\Omega$

$V = 12\,V$

Now, $R_{56} = R_5 + R_6$

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

$= 11\,k\Omega$

$$R_{456} = \frac{1}{\frac{1}{R_4} + \frac{1}{R_{56}}} = 0.917\,k\Omega$$

$R_{3456} = R_3 + R_{456} = 10.917\,k\Omega$

$$R_{23456} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_{3456}}} = 0.916\,k\Omega$$

$R_{123456} = R_1 + R_{23456} = 10.916\,k\Omega$

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

$$= \frac{12}{10.916 \times 10^3} = 1.099 \times 10^{-3}\,A$$

$V_{23456} = (1.099 \times 10^{-3} \times 0.916 \times 10^3)\,V = 1.055\,V$

$I_1 = 1.099 \times 10^{-3}\,A$

$V_1 = I_1 R_1 = 1.099 \times 10^{-3} \times 10 \times 10^3$

$= 10.99\,V$

$\therefore I_{23456} = 1.099 \times 10^{-3}\,A$

$I_2 = \frac{V_2}{R_2} = \frac{1.055}{1\times10^3} = 1.055\times10^{-3}A$

$I_{3456} = \frac{1.055}{10.917\times10^3} = 9.66\times10^{-5}A$

$R_{3456} = 10.917\ K\Omega$

$V_{3456} = 1.055V$ $\quad \therefore I_{3456} = 9.66\times10^{-5}$

$V_3 = 9.66\times10^{-5}\times10\times10^3 = 0.966V$

$V_{456} = 0.917\times10^3 \times 9.66\times10^{-5} = 0.0886V$

$R_{456} = 0.917\ K\Omega$ $\quad \therefore I_3 = 9.66\times10^{-5}A$

$I_{456} = 9.66\times10^{-5}A$

$V_{456} = 0.0886V$

$I_4 = \frac{0.089}{1\times10^3} = 8.9\times10^{-5}A$

$I_{56} = \frac{0.089}{11\times10^3} = 8.09\times10^{-6}A$

$R_{56} = 11K\Omega$

$V_{56} = 0.089V$

$I_{56} = 8.09\times10^{-6}A$

$V_4 = 0.089V$

$I_4 = 8.9\times10^{-5}A$

$R_6 = 1K\Omega$

$I_6 = 8.09\times10^{-6}A$

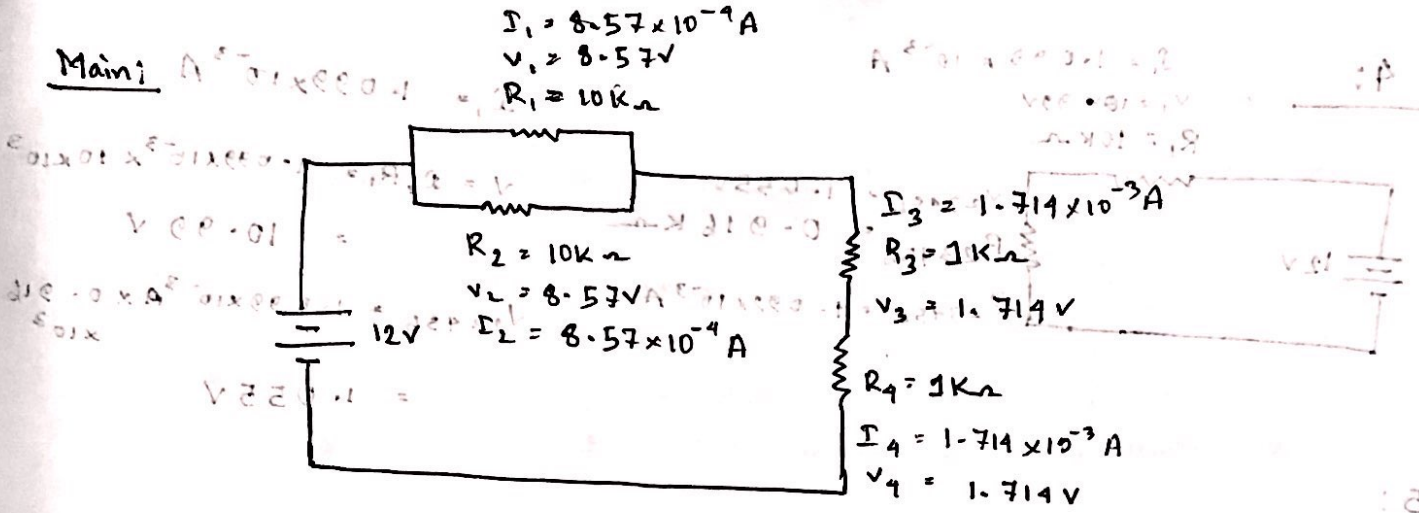
$V_6 = 8.09\times10^{-3}V$

$V_5 = 0.0809V$

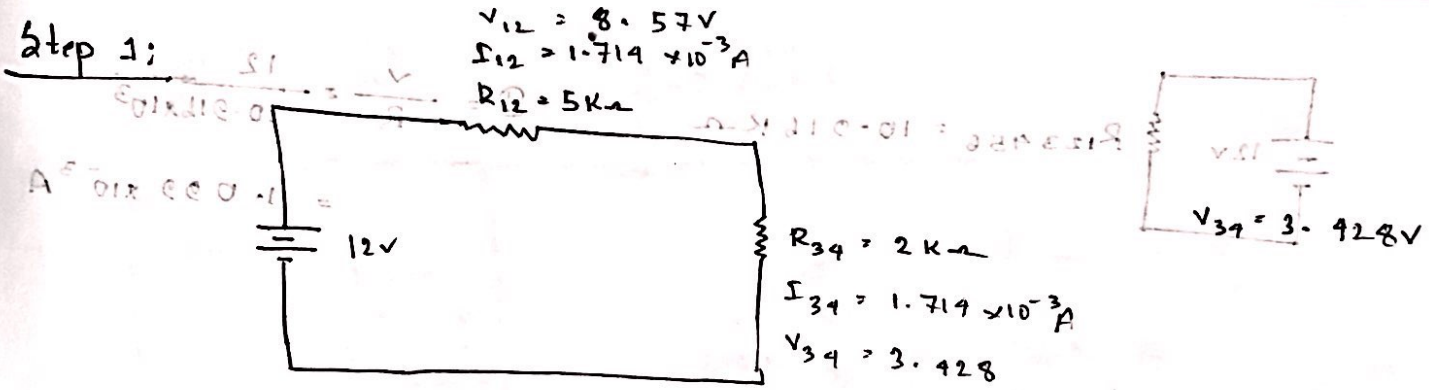
$I_5 = 8.09\times10^{-6}A$

$R_5 = 10K\Omega$

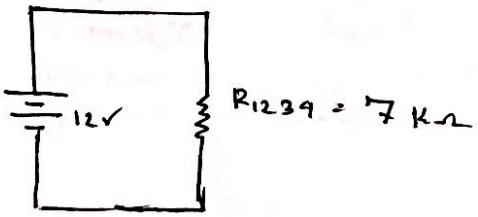
Main;



Step 1;



Step 2:



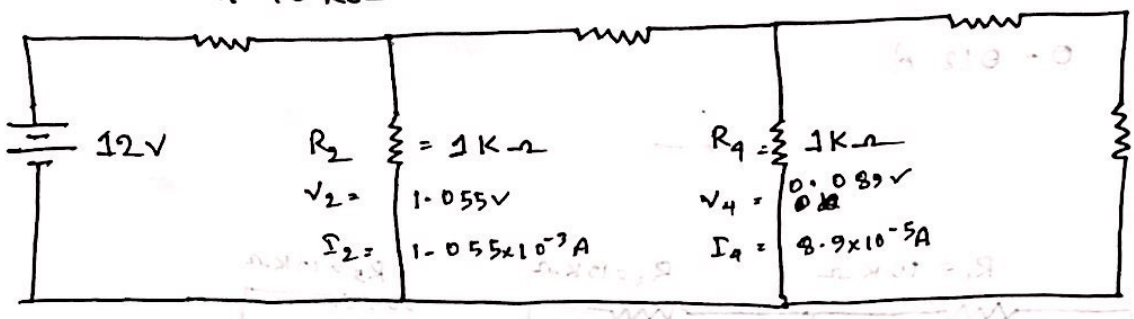
$$I = \frac{12}{7 \times 10^3} = 1.719 \times 10^{-3} A$$

Main:

$V_1 = 10.99V$
$I_1 = 1.099 \times 10^{-3} A$
$R_1 = 10K\Omega$

$I_3 = 9.66 \times 10^{-5} A$
$V_3 = 0.966V$
$R_3 = 10K\Omega$

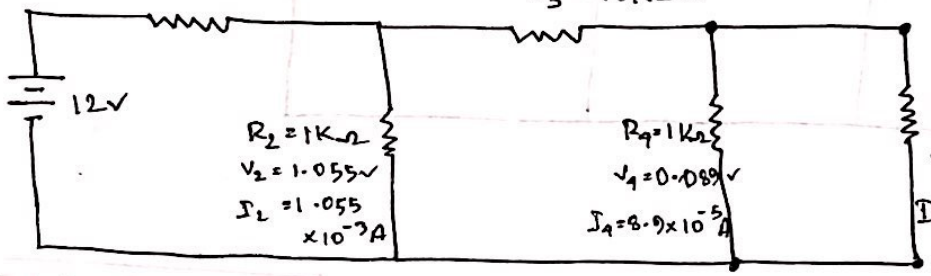
$V_5 = 0.0809V$
$I_5 = 8.09 \times 10^{-6} A$
$R_5 = 10K\Omega$



Step 1:

$V_1 = 10.99V$
$I_1 = 1.099 \times 10^{-3} A$
$R_1 = 10K\Omega$

$V_3 = 0.966V$
$I_3 = 9.66 \times 10^{-5} A$
$R_3 = 10K\Omega$



$I_4 = \frac{0.089}{1 \times 10^3}$

$= 8.9 \times 10^{-5} A$

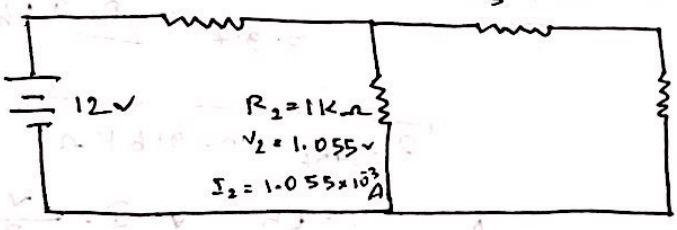
$I_{56} = \frac{0.089}{11 \times 10^3}$

$= 8.09 \times 10^{-6} A$

Step 2:

$V_1 = 10.99V$
$I_1 = 1.099 \times 10^{-3} A$
$R_1 = 10K\Omega$

$V_3 = 0.966V$
$I_3 = 9.66 \times 10^{-5} A$
$R_3 = 10K\Omega$



$V_3 = 9.66 \times 10^{-5} \times 10 \times 10^3$

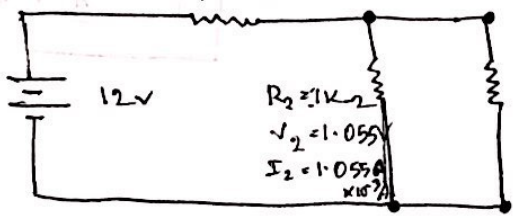
$= 0.966V$

$V_{456} = 0.917 \times 10^3 \times 9.66 \times 10^{-5}$

$= 0.0886V$

Step 3:

$V_1 = 10.99V$
$I_1 = 1.099 \times 10^{-3} A$
$R_1 = 10K\Omega$



$I_2 = \frac{V_2}{R_2}$

$= \frac{1.055}{1 \times 10^3}$

$= 1.055 \times 10^{-3} A$

$I_{3456} = \frac{1.055}{10.917 \times 10^3}$

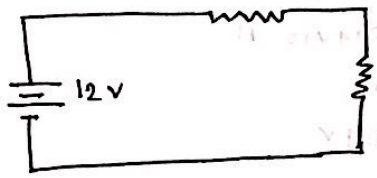
$= 9.66 \times 10^{-5}$

Step 4:

$I_1 = 1.099 \times 10^{-3}$ A

$V_1 = 10.99$ V

$R_1 = 10$ KΩ



$V_{23456} = 1.055$ V

$R_{23456} = 0.916$ KΩ

$I_{23456} = 1.099 \times 10^{-3}$ A

$I_1 = 1.099 \times 10^{-3}$ A

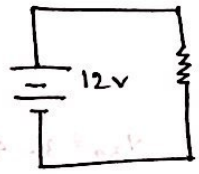
$V_1 = I_1 R_1 = 1.099 \times 10^{-3} \times 10 \times 10^3$

$= 10.99$ V

$V_{23456} = 1.099 \times 10^{-3} \times 0.916 \times 10^3$

$= 1.055$ V

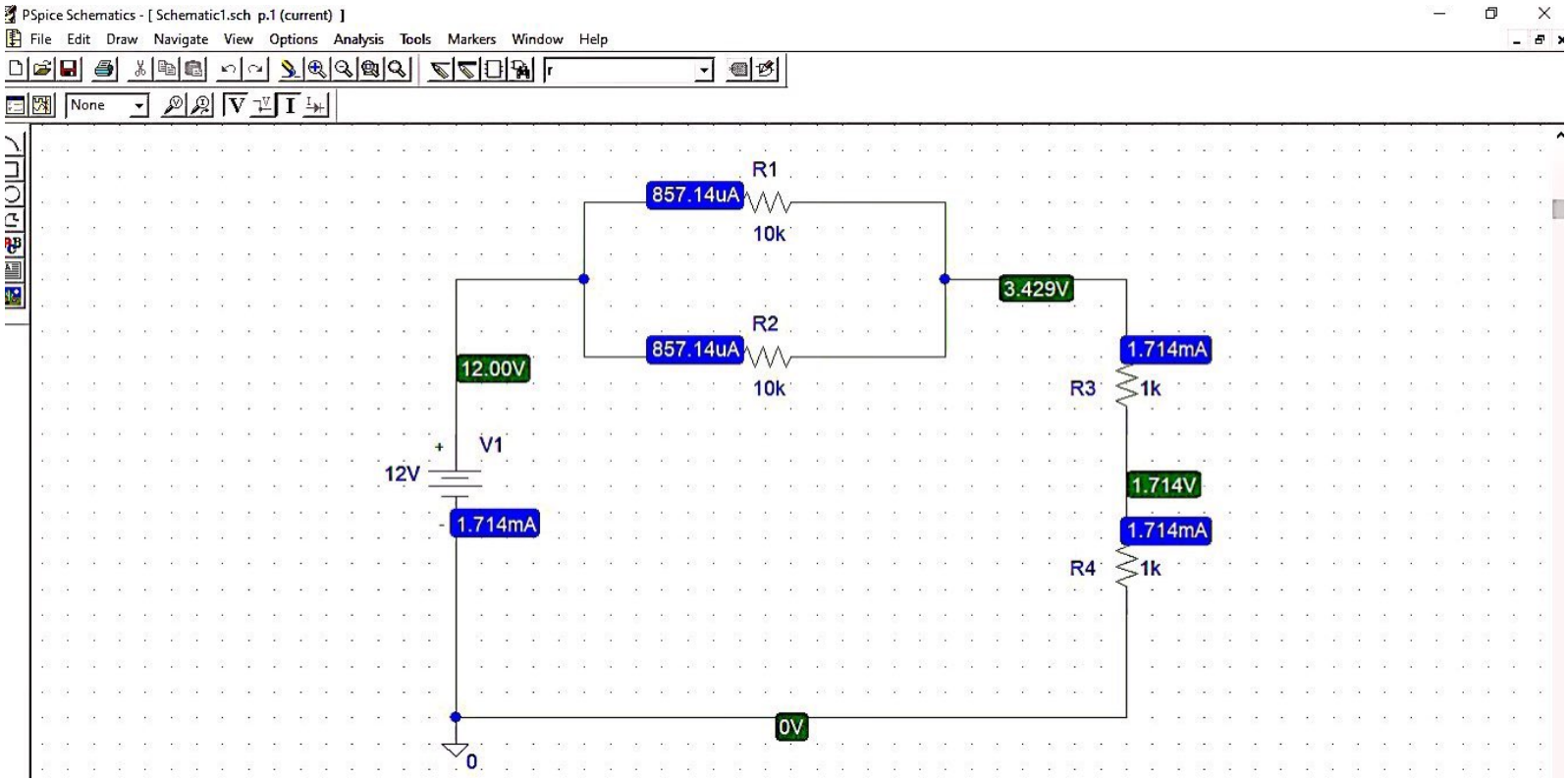
Step 5:

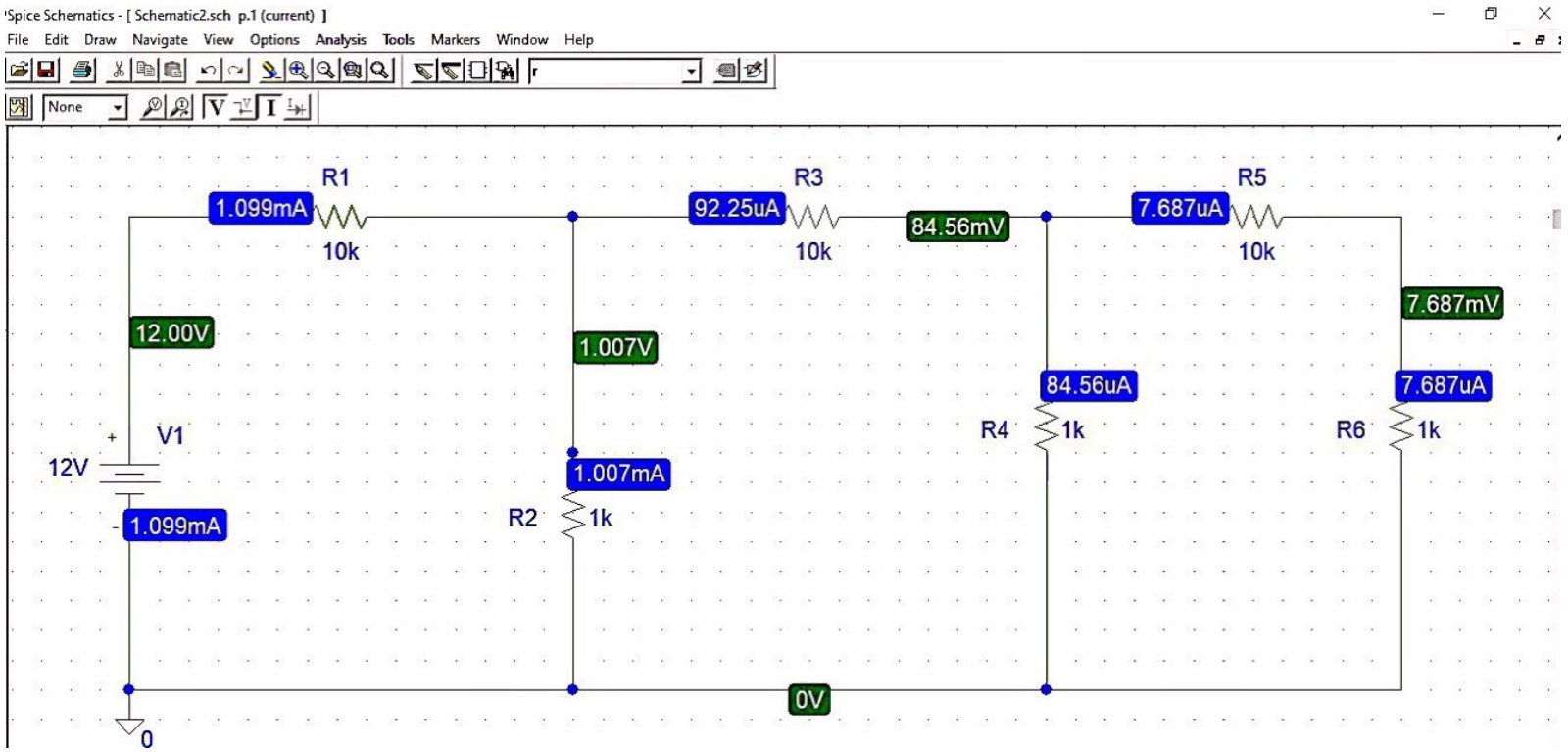


$R_{123456} = 10.916$ KΩ

$I = \frac{V}{R} = \frac{12}{10.916 \times 10^3}$

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

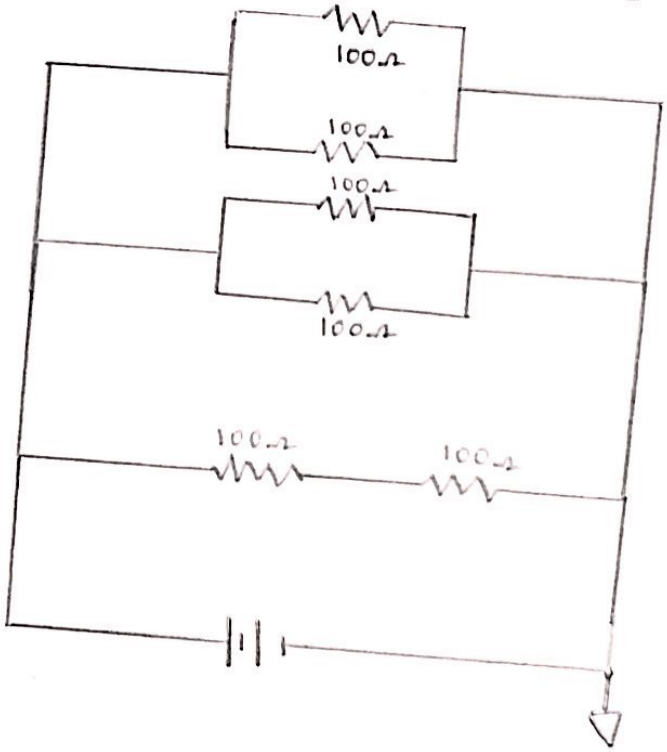




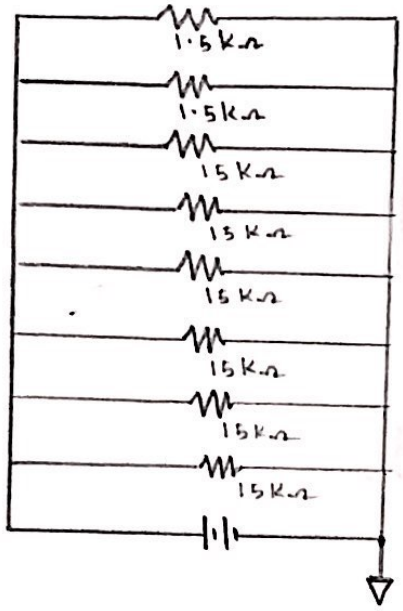
Questions Answers:

The recorded value of the resistors and the value of currents were same as the PSpice simulation for the initial figure. However, there was slight change in decimal values for the following figure.

Six 100 Ω resistors and I have to arrange it so the effective value would be 300 Ω.



Two 1.5kΩ resistors and six 15kΩ resistors to make an effective resistance value of 3.25kΩ



Discussion: The following experiment gave us idea about how to connect different series and parallel circuits in bread board. The experiment was done flawlessly and the values got from PSpice software simulation and theoretically was same. So it can be said that it was a successful experiment and the challanges were overcome so technically.