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Course : CSE 250

Expriment : 02 no

Expriment name : Introduction to series and parallel circuits.

1. Object :- The expriment 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 / Trainer board
- Multimeter.

③ Circuit / Block / system Diagram :-

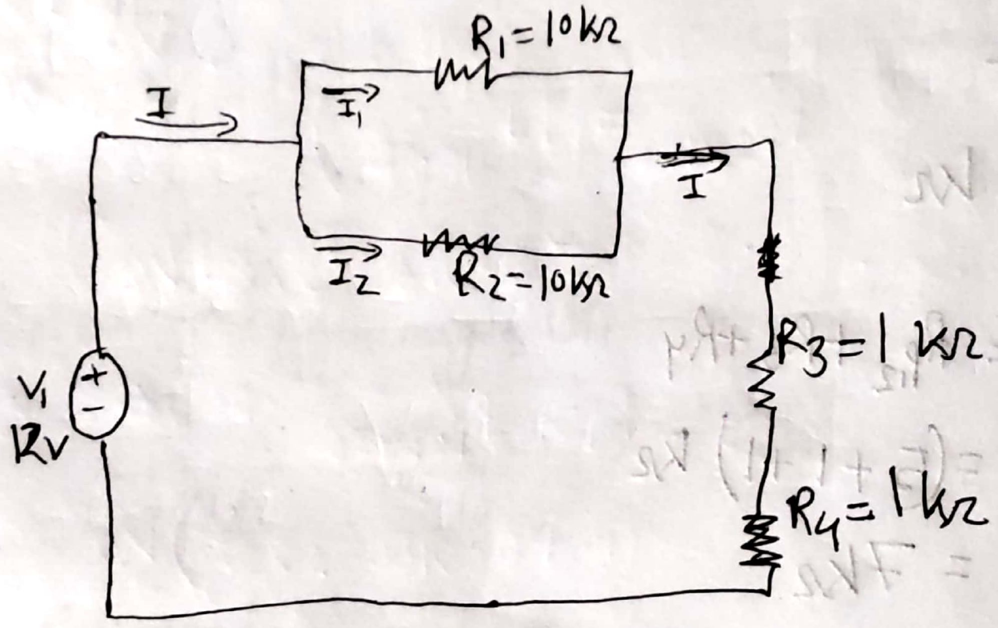

Figure-1

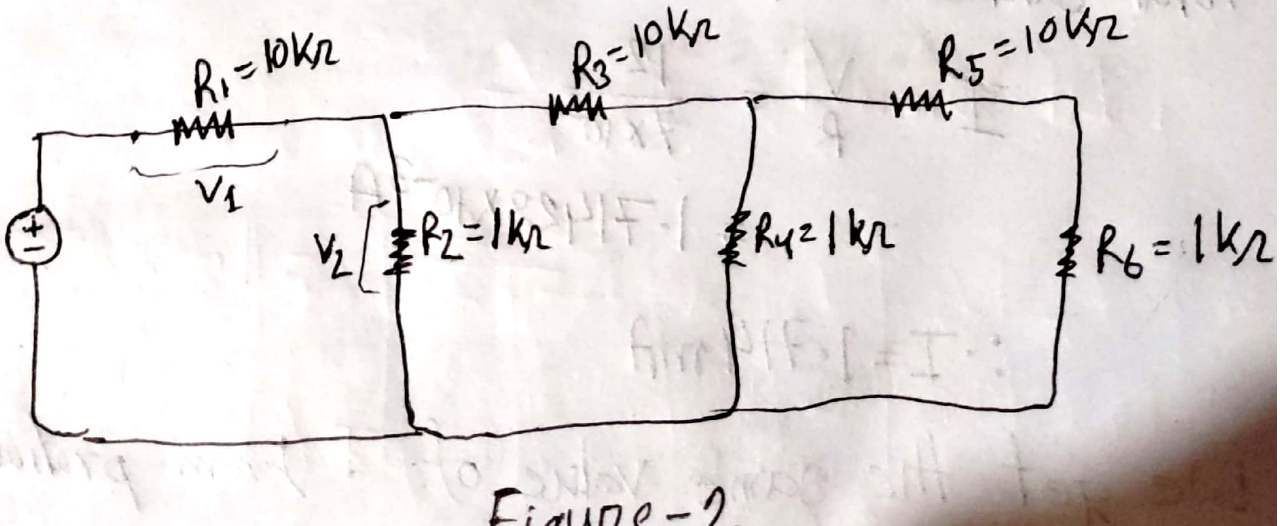

Figure-2

4. Result:-

For Figure-1:- $V_1 = 12V$

$R_1 = 10k\Omega$

$R_2 = 10k\Omega$

$R_3 = 1k\Omega$

$R_4 = 1k\Omega$

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

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

$$= \frac{2}{10}$$

$$R_{P_{12}} = 5\,k\Omega$$

Again, $R_P = R_{P_{12}} + R_3 + R_4$

$$= (5+1+1)\,k\Omega$$

$$= 7k\Omega$$

Total current (I) in the circuit.

$$I = \frac{V}{R} = \frac{12}{7 \times 10^3}$$

$$= 1.71428 \times 10^{-3} A$$

$$\therefore I = 1.714\,mA$$

We get the same value of I from proteus simulation too.

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Now, here R_3 & R_4 are in series, so their current (I) will be same. but there will be some voltage drop.

$$V_2 = I(R_1+R_2)$$
$$= 1.714 \times (1+1)$$
$$V_2 = 3.42857$$

Total voltage, V=12V

$$V_1 = (12-3.42857)$$
$$= 8.57143V$$

Now, current through R_1,

$$I_1 = \frac{V_1}{R_1} = \frac{8.57143V}{10 k\Omega} = 857.1428572 \mu A$$

current through, R_2

$$I_2 = \frac{V_2}{R_2} = \frac{8.57143}{10} = 857.1428572 \mu A$$

Data Table :-

V_1 (V)	V_2 (V)	V_1+V_2	I_1 (μA)	I_2 (μA)	I mA
8.5714	3.42857	11.99~12	854.14	857.14	1.714

For Figure-2:

$V_1 = 12\,V$

$R_1 = 10\,k\Omega$

$R_2 = 1\,k\Omega$

$R_3 = 10\,k\Omega$

$R_4 = 1\,k\Omega$

$R_5 = 10\,k\Omega$

$R_6 = 1\,k\Omega$

$R_{S56} = (10+1)\,k\Omega$
$= 11\,k\Omega$

$R_{P456} = \left(\frac{1}{1} + \frac{1}{11}\right)^{-1}$
$= 0.91667\,k\Omega$

$R_{S3456} = R_3 + R_{S456}$
$= (10 + 0.91667)$
$= 10.91667\,k\Omega$

$R_{P23456} = \left(1 + \frac{1}{10.91667}\right)^{-1}$

$= 0.9160839396\,k\Omega$

$\therefore R_S = R_1 + R_{P23456}$

$= (10 + 0.9160839396)\,k\Omega$

$= 10.916\,k\Omega$

Total current, $I = \frac{V}{R_S}$

$= \frac{12}{10.91608} = 1.097295718\,mA$

This is similar to the protions.

In R_1,

voltage, $V = I \times R_1$

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

$= 10.992957$

After voltage drop in R_1,

$V_2 = (12 - 10.992957)\,V$

$= 1.007\,V$

In R_2, $I_2 = \frac{V_2}{R_2} = \frac{1.007}{1 \times 10^{-3}} = 1.007\,mA$

$I_3 = \frac{V_2}{R_{S3456}} = \frac{1.007}{10.917 \times 10^{3}} = 9.22414 \times 10^{-5}$

$= 92.2415\,\mu A$

After passing R_3, Bacause of volltage drop,

$V_3 = (1.007 - (92.2415 \times 10^{-6} \times 10 \times 10^{3}$

$= 0.0845\,V$

In R_4, $I_4 = \frac{V_3}{R_4}$

$$= \frac{0.0845}{1 \times 10^{-3}} = 84.5 \mu A$$

Current running in R_{556},

$$I_{56} = \frac{V_3}{R_{556}} = \frac{0.0845}{11 \times 10^3} = 7.6818 \mu A$$

While passing R_5, There will be a voltage drop

$$V_4 = (0.0845 - (7.6818 \times 10^{-6} \times 10 \times 10^3))$$

$$= 7.682 \text{ mV} = 0.007\cancel{6}8 \text{ V}$$

R_5 and R_6 are in series, so current will be same for those two.

$$I_6 = 7.682 \text{ mA}$$

V_1	V_2	V_3	V	I_1	I_2	I_3	I_4	I_5	I_6	I
0.993	1.007	0.0845	12	1.099	1.007	0.092	0.084	0.00768	0.00768	1.099

$\boxed{V_4 \rightarrow 0.00768}$

5. Question & Answers:-

(1) we have calculated the ~~circuit~~ currents, and implemented in circuit. Both the values of currents from formula and circuits were same.

(2) Six 100Ω resistors,

If R_2 and R_3 are in series,

$$R_{S23} = 200\Omega$$

if R_4 and R_5 ar in pattallel,

$$R_{P45} = \left(\frac{1}{100} + \frac{1}{100}\right)^{-1}$$

$$= 50\Omega$$

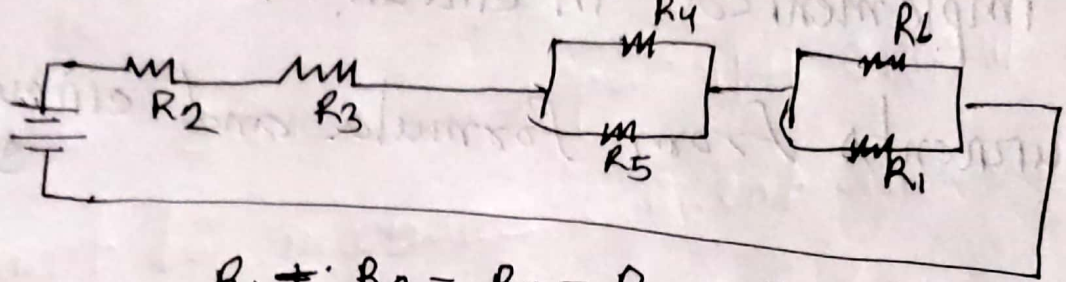
if R_1 and R_6 are in parallel,

$$R_{61} = \left(\frac{1}{100} + \frac{1}{100}\right)^{-1}$$

$$= 50\Omega$$

Now taking R_{S23}, R_{P45}, R_{P61} in series.

$$R = (200 + 50 + 50)\,\Omega$$
$$= 300\,\Omega$$



$R_1 = R_2 = R_3 = R_4 = R_5 = R_6 = 100\,\Omega$

③ Given that,

Two $1.5\,k\Omega$ resistors,
six $15\,k\Omega$ resistors

R_1 and R_2 in parallel,

$$R_{12} = \left(\frac{1}{1.5\times10^3} + \frac{1}{1.5\times10^3}\right)^{-1}$$
$$= 750\,\Omega = .75\,k\Omega$$

R_3 & R_4 are in parallel,

$$R_{34} = \left(\frac{1}{15} + \frac{1}{15}\right)^{-1}$$
$$= 7.2\,k\Omega$$

R_6, R_7, R_8 in Parallel,

$$R_{678} = (15^{-1} + 15^{-1} + 15^{-1})$$
$$= \frac{15}{3} = 5\,k\Omega$$

* $R_5 ; R_{P34}, R_{678}$ are in parallel,

$$\frac{1}{R_P} = \left(\frac{1}{15} + \frac{2}{15} + \frac{3}{15}\right)^{-1}$$

$$= 2.5\,k\Omega$$

or $R_{3,4,5,6,7,8}$ in Parallel, or six $15\,k\Omega$ in parallel,

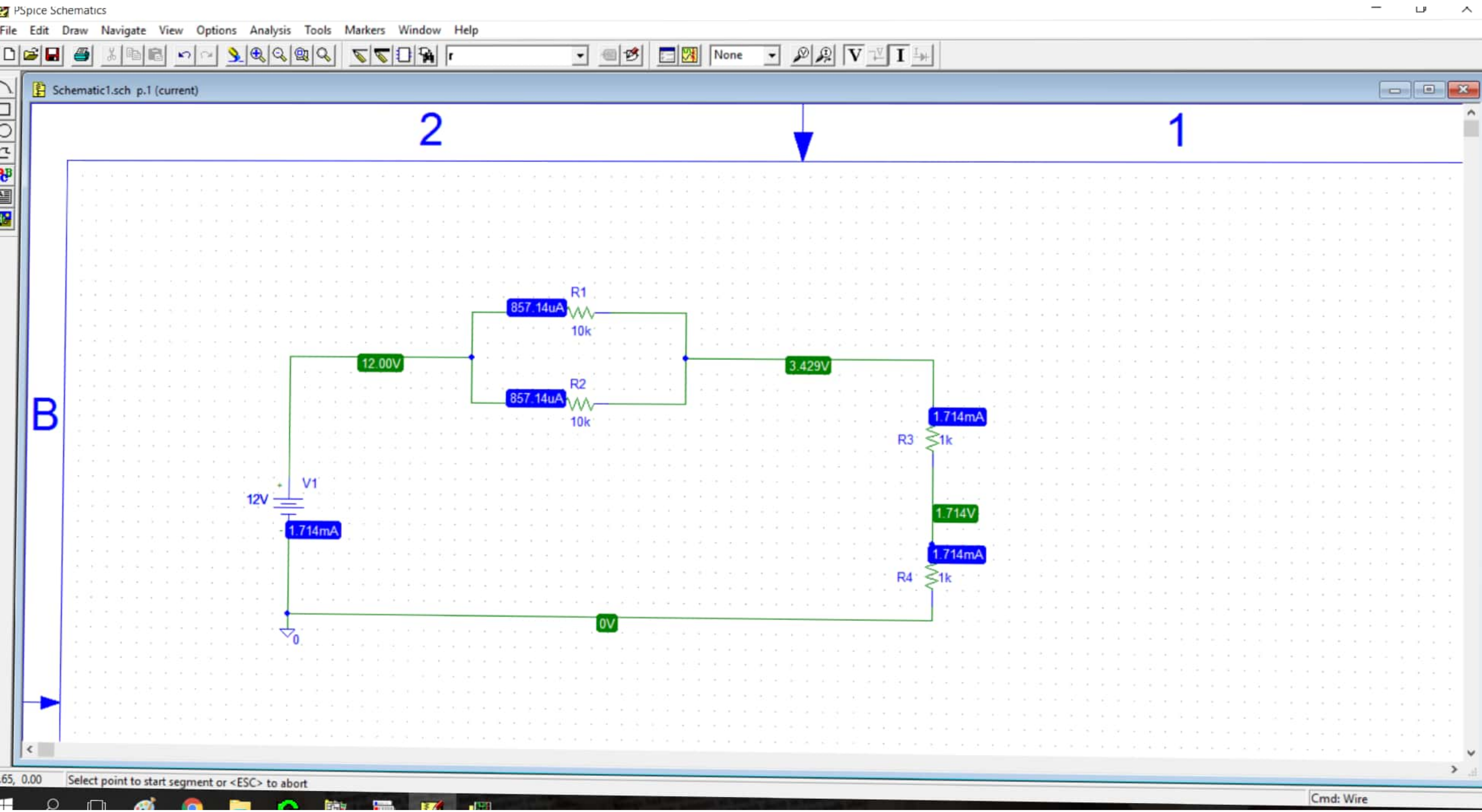
$$R_P = \left(15^{-1} + 15^{-1} + 15^{-1} + 15^{-1} + 15^{-1} + 15^{-1}\right)^{-1}$$
$$= \left(\frac{6}{15}\right)^{-1}$$
$$= \frac{15}{6} = 2.5\,k\Omega$$

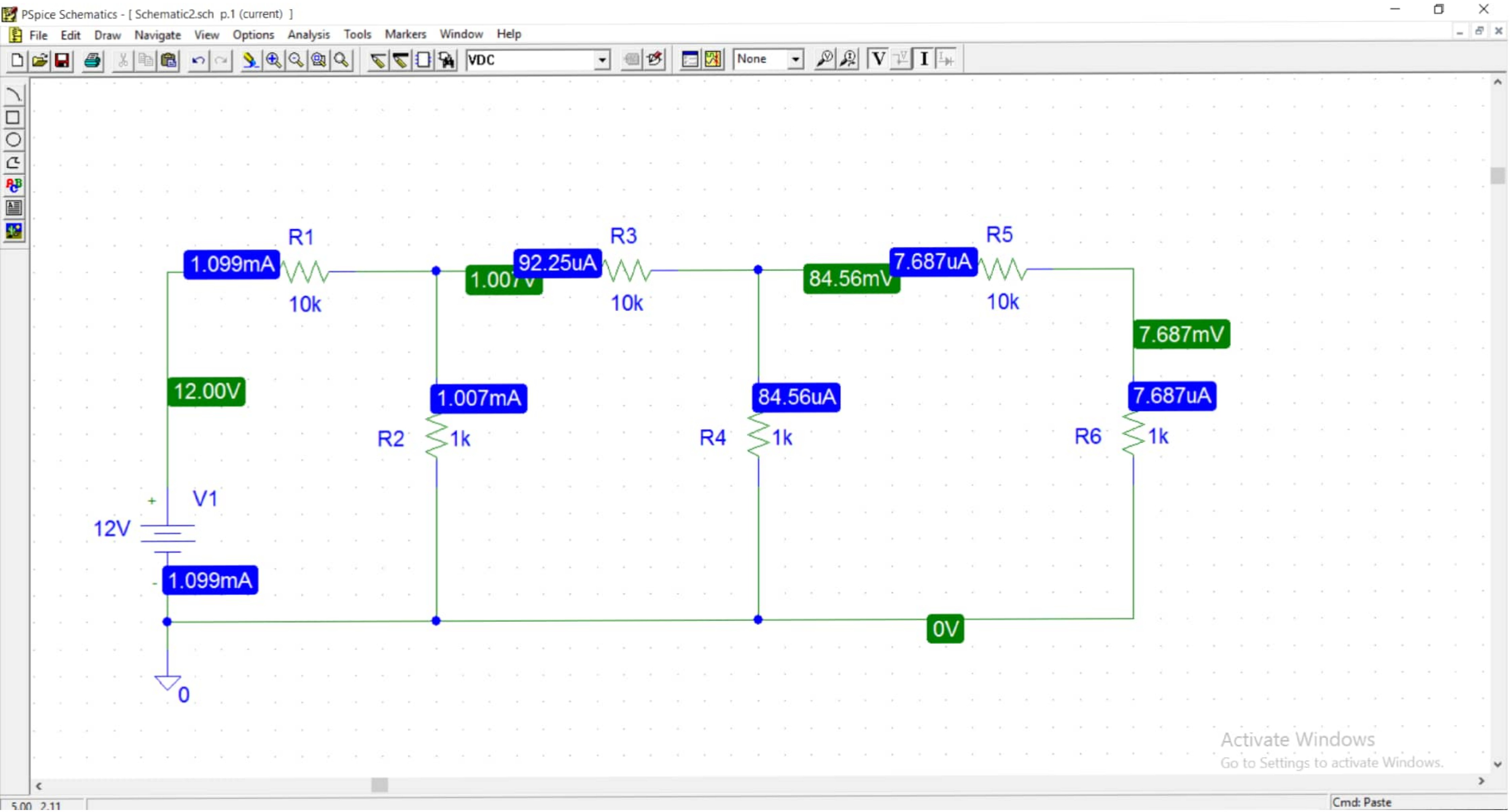
and R_{12} and R_P are in series,

$$R = R_{12} + R_P$$
$$= (0.75 + 2.5)\,k\Omega$$
$$= 3.25\,k\Omega$$

6) Discussion :

Through this lab we learnt how to build series and parallel circuit, we learnt to measure current and voltage, voltage drop. we proved that current is same in the resistors when they are in series and voltage is same when they are in parallel. That was main goal of This Lab.


PSpice Schematics
File Edit Draw Navigate View Options Analysis Tools Markers Window Help
None
Schematic1.sch p.1 (current)
2
1
B
R1
857.14uA
10k
R2
857.14uA
10k
12.00V
3.429V
1.714mA
R3
1k
1.714V
1.714mA
R4
1k
V1
12V
1.714mA
0V
0
Select point to start segment or <ESC> to abort
Cmd: Wire


PSpice Schematics - [Schematic2.sch p.1 (current)]
File Edit Draw Navigate View Options Analysis Tools Markers Window Help
VDC
None
R1
1.099mA
10k
1.007V
92.25uA
R3
10k
84.56mV
7.687uA
R5
10k
7.687mV
12.00V
1.007mA
R2
1k
84.56uA
R4
1k
7.687uA
R6
1k
V1
12V
1.099mA
0V
0
Activate Windows
Go to Settings to activate Windows.
5.00 2.11
Cmd: Paste