LAB 2

CSE250

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Section: 01

CSE250

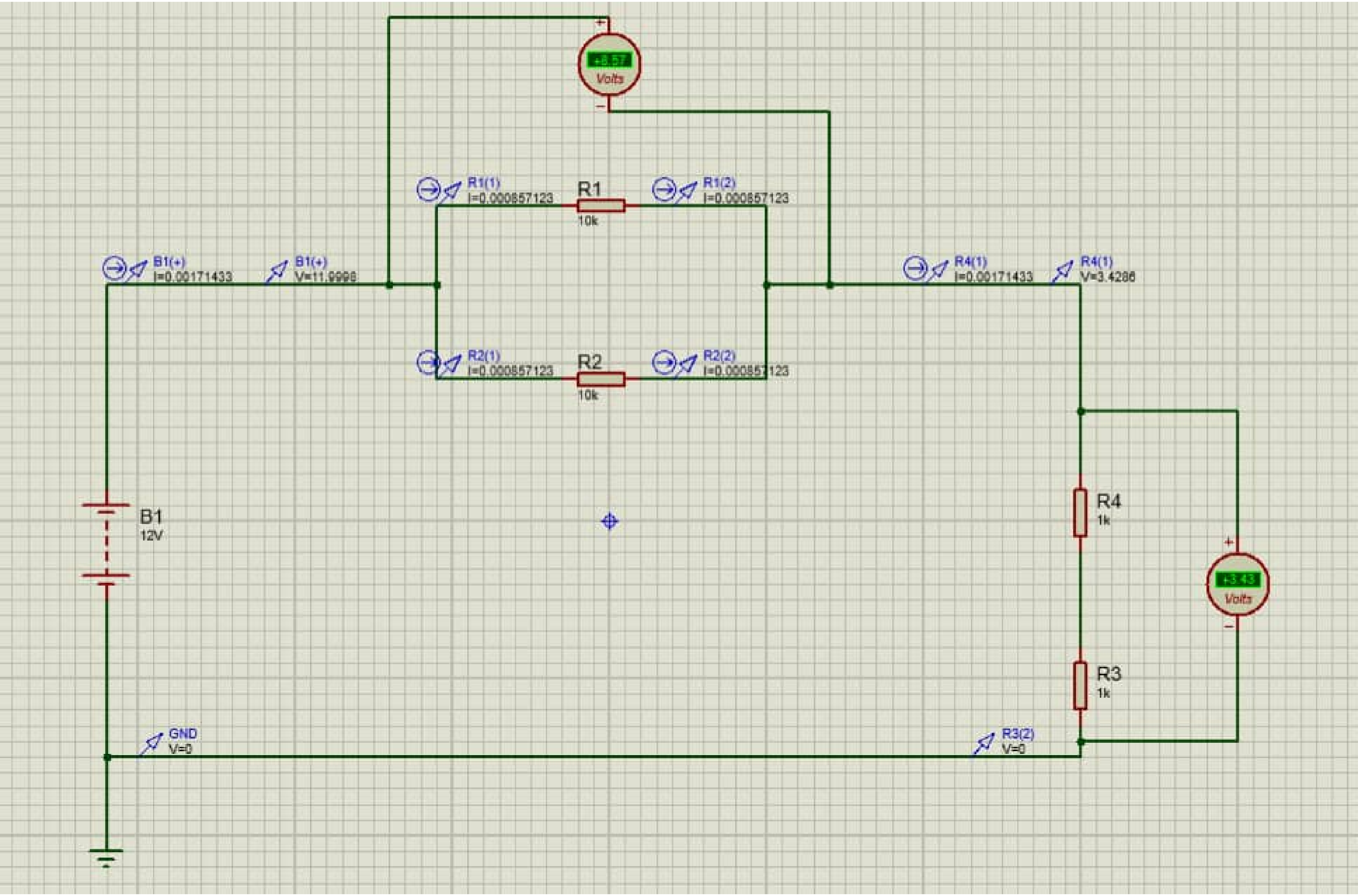
Name of the Experiment: Introduction to series and parallel circuits.

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.

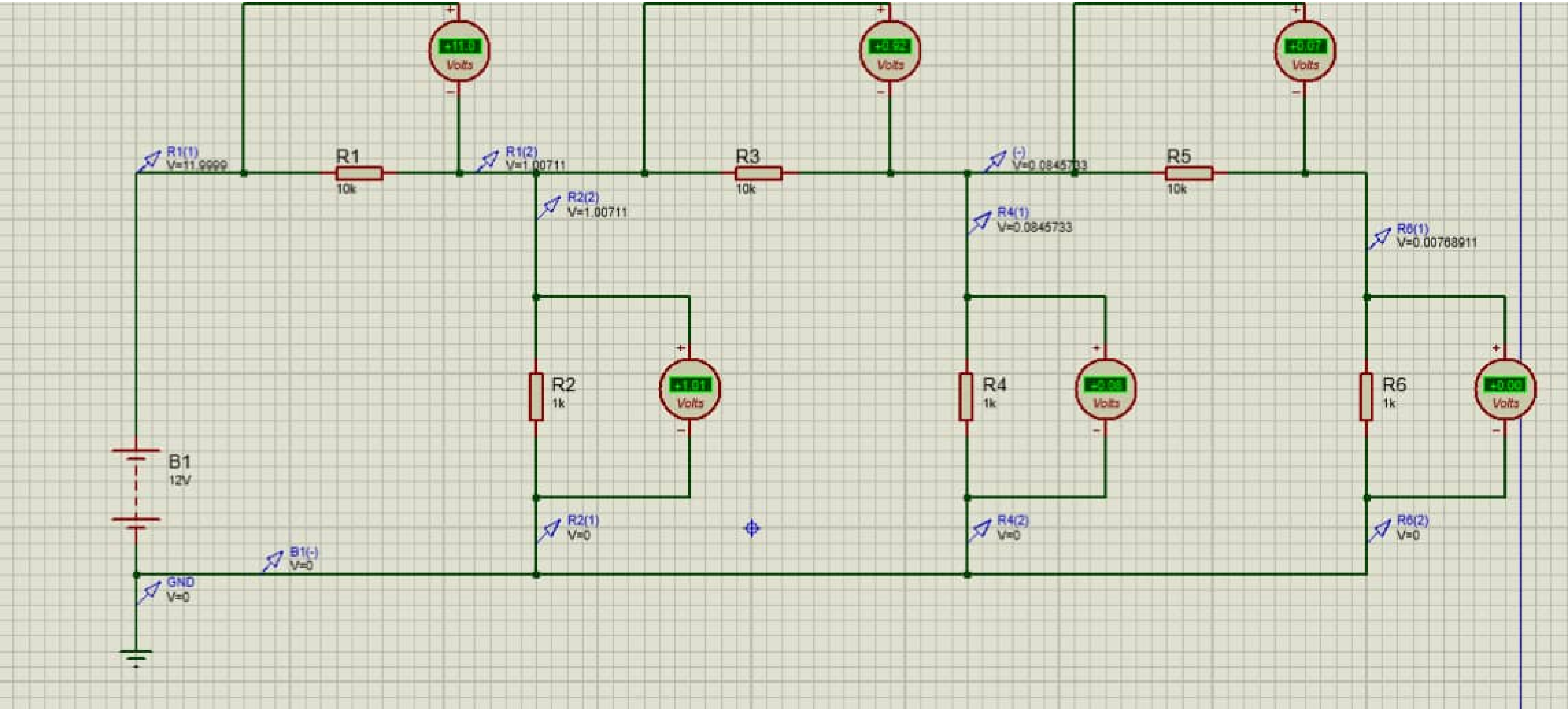
Apparatus:

- DC power supplies
- Resistors
- Bread board/Trainer board
- Multimeter

Circuits and Procedure:



+8.57
Volts
R1(1)
I=0.000857123
R1
10k
R1(2)
I=0.000857123
B1(+)
I=0.00171433
B1(+)
V=11.9998
R4(1)
I=0.00171433
R4(1)
V=3.4286
R2(1)
I=0.000857123
R2
10k
R2(2)
I=0.000857123
B1
12V
R4
1k
+3.43
Volts
R3
1k
GND
V=0
R3(2)
V=0


+11.0
+0.92
+0.07
Volts
R1(1)
V=11.9999
R1
10k
R1(2)
V=1.00711
R3
10k
(-)
V=0.0845733
R5
10k
R2(2)
V=1.00711
R4(1)
V=0.0845733
R6(1)
V=0.00768911
R2
1k
+1.01
R4
1k
R6
1k
+0.00
B1
12V
R2(1)
V=0
R4(2)
V=0
R6(2)
V=0
B1(-)
V=0
GND
V=0

Reports:

For circuit 1:

Here,

$V = 12V$

$R_1 = 10k\Omega$

$R_2 = 10k\Omega$

$R_3 = 1k\Omega$

$R_4 = 1k\Omega$

$I_1 = \frac{V_1}{R_1} = \frac{8.57}{10}$ mA

$= 0.857$ mA

$I_2 = \frac{V_2}{R_2} = \frac{8.57}{10}$

$= 0.857$ mA

V_1 (Volts)	V_2 (Volts)	$V=V_1+V_2$ (Volts)	I_1 (mAmp)	I_2 (mAmp)	$I=I_1+I_2$ (mAmp)
8.57V	3.43V	12V	0.857mA	0.857mA	1.714mA

For circuit 2:

$V = 12V$

$R_1 = 10k\Omega$

$R_2 = 1k\Omega$

$R_3 = 10k\Omega$

$R_4 = 1k\Omega$

$R_5 = 10k\Omega$

$R_6 = 1k\Omega$

$I_1 = \frac{V_1}{R_1} = \frac{11}{10} = 1.1mA$

$I_2 = \frac{V_2}{R_2} = \frac{1.01}{1} = 1.01 mA$

$I_3 = \frac{V_3}{R_3} = \frac{0.92}{10} = 0.092 mA$

$I_4 = \frac{V_4}{R_4} = \frac{0.08}{1} = 0.08 mA$

$I_5 = \frac{V_5}{R_5} = \frac{0.07}{10} = 0.007 mA$

$I_6 = \frac{V_6}{R_6} = \frac{0.007}{1} = 0.007 mA$

V_1	V_2	V_3	V_4	V_5	V_6	I_1(A)	I_2(A)	I_3(A)	I_4(A)	I_5(A)	I_6(A)
11V	1.01V	0.92V	0.08V	0.07V	0.007V	1.1mA	1.01mA	0.092mA	0.08mA	0.007mA	0.007mA

$V_{Total} = 13.087 V$

$V_{given} = 12V$

The calculated value from the circuit using multimeter is not same as the given one. So, this is one of the discrepancies I came up to.

Ans. to the question no. 1

In circuit 1,

Here,

$V = 12V$

$R_1 = 10k\Omega$

$R_2 = 10k\Omega$

$R_3 = 1k\Omega$

$R_4 = 1k\Omega$

For $R_1, R_2 \Rightarrow$

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

$$= \left(\frac{1}{10} + \frac{1}{10}\right)^{-1} k\Omega$$

$$= \left(\frac{1}{5}\right)^{-1} k\Omega$$

$$= 5k\Omega$$

$$R_{eqv} = R_p + R_3 + R_4$$

$$= 5 + 1 + 1$$

$$= 7k\Omega$$

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

$$= \frac{12}{7} mA$$

$$= 1.714 mA$$

for circuit-2,

$R_1 = 10k\Omega$

$R_2 = 1k\Omega$

$R_3 = 10k\Omega$

$R_4 = 1k\Omega$

$R_5 = 10k\Omega$

$R_6 = 1k\Omega$

$V = 12V$

Here,

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

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

$$= 11\,k\Omega$$

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

$$= \left(\frac{1}{11} + \frac{1}{1}\right)^{-1}$$

$$= \left(\frac{1+11}{11}\right)^{-1}$$

$$= \left(\frac{12}{11}\right)^{-1} = \frac{11}{12}\,k\Omega$$

$$R_{pc} = (R_3 + R_{p_b})$$

$$= \left(10 + \frac{11}{12}\right) k\Omega$$

$$= \left(\frac{120+11}{12}\right) k\Omega$$

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

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

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

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

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

$$= \left(\frac{143}{131}\right)^{-1} = \frac{131}{143}$$

$$R_{eqv} = (R_1 + R_{pd})\,k\Omega$$

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

$$= \left(\frac{1430+131}{143}\right) k\Omega$$

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

$$= 10.91\,k\Omega$$

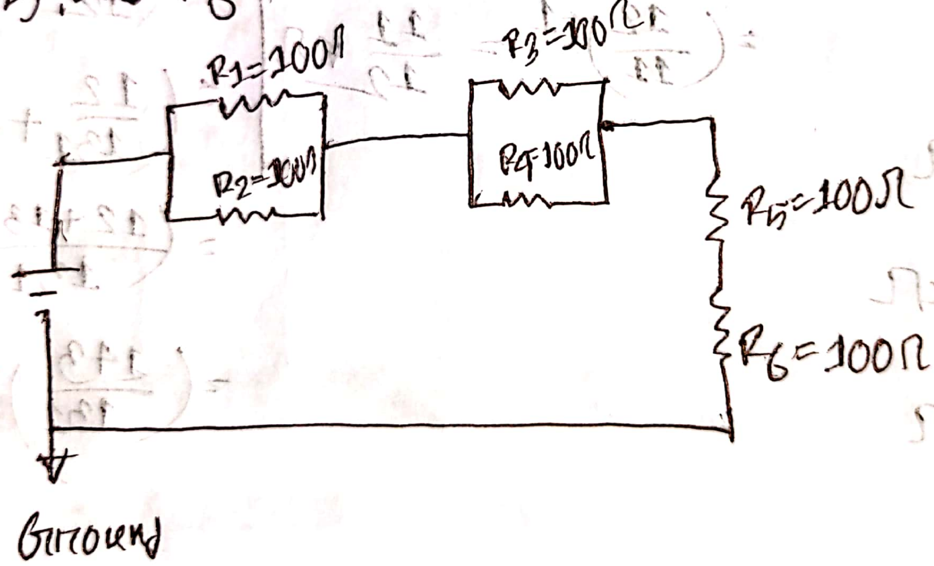
$$I = \frac{V}{R_{eqv}} = \frac{12}{10.91} \text{ mA}$$

$$= 1.099 \text{ mA}$$

So, we can see that the calculated value of the current is the same as the multimeter gave in the circuit.

Ans. to the question no. 2

We can have 300 ohm, if we connect $(R_1 \| R_2)$ series with $(R_3 \| R_4)$ series with R_5 and R_6.



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

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

$$= 50 + 50 + 100 + 100$$

$$= 300\Omega \text{ (Ans)}$$

Ans. to the question. no. 3

Here, $R_3 = R_4 = R_5 = R_6 = R_7 = R_8 = 15 K\Omega$

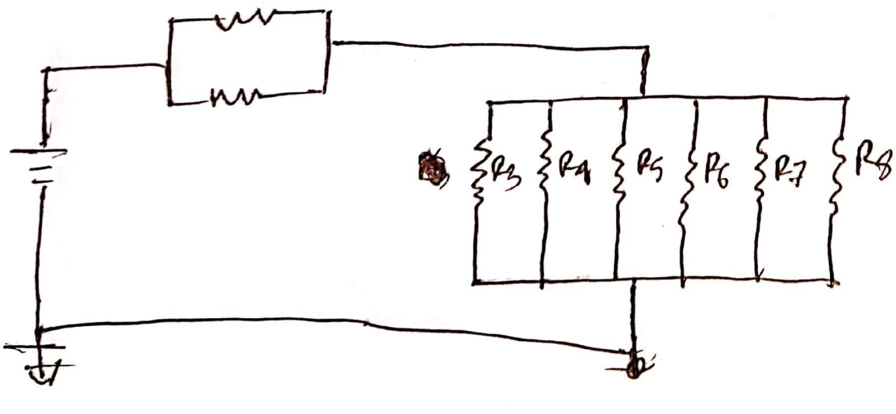
$R_1 = R_2 = 1.5 K\Omega$

Now, $(R_1 \| R_2)_{series} (R_3 \| R_4 \| R_5 \| R_6 + R_7 \| R_8)$

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

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

$$= \frac{3}{4} + \frac{5}{2} = \frac{13}{4} = 3.25 K\Omega$$



Discussion: Applying the circuits like this, we achieve the value of $3.25 K\Omega$.