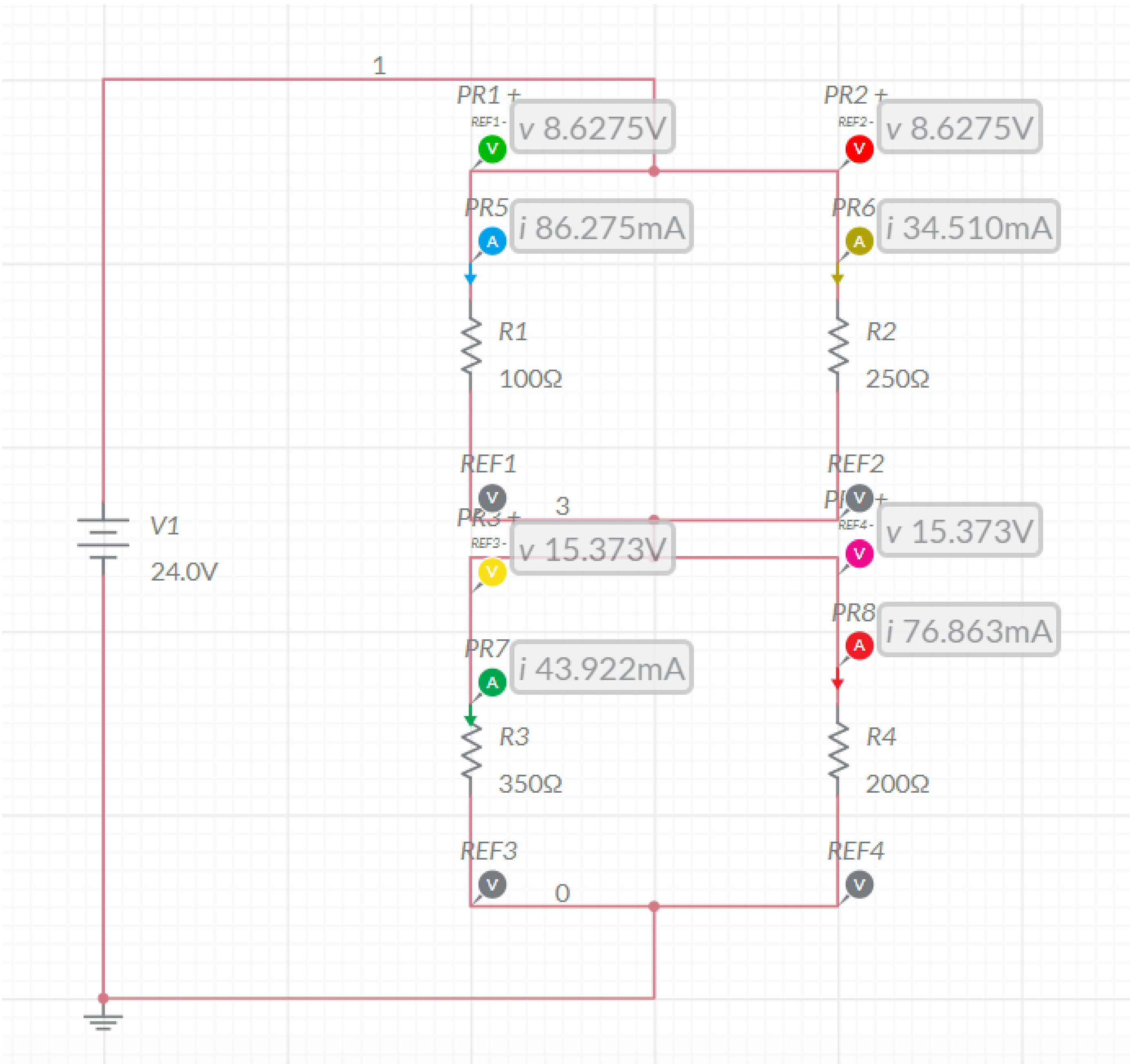
DIGITAL ELECTRONICS & LOGIC DESIGN LAB

LAB 1: ASSIGNMENT 1 & 2

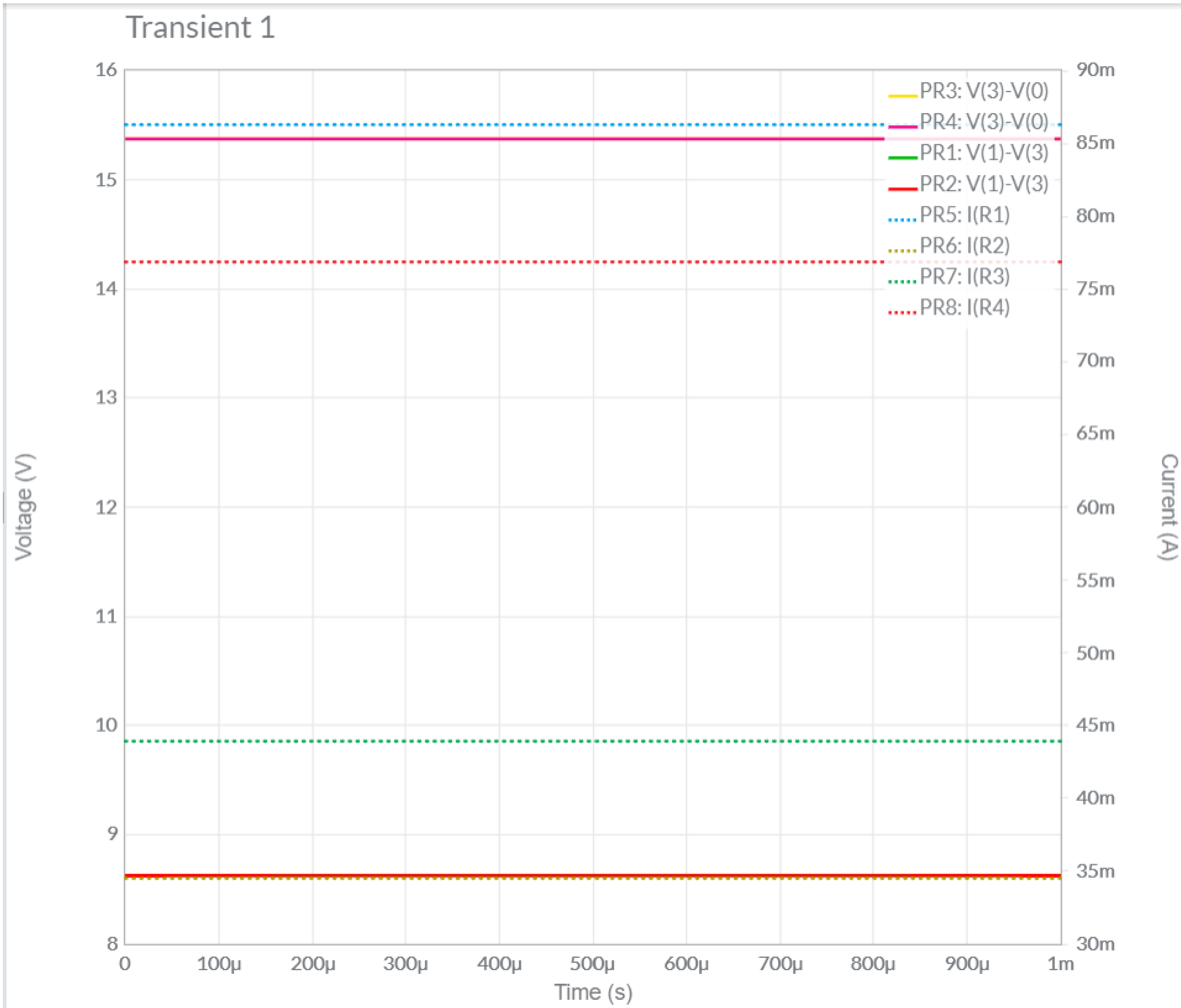
Submitted By: U19CS012 (D-12)
BHAGYA VINOD RANA | C.S.E., SVNIT

Assignment -1

a.) Implement the circuit as shown in Figure in Multisim online.



b.) Evaluate the current and voltage across each resistor using simulator.



DC OP 1

Signal	Value
PR3: V(3)-V(0)	15.373V
PR4: V(3)-V(0)	15.373V
PR1: V(1)-V(3)	8.6275V
PR2: V(1)-V(3)	8.6275V
PR5: I(R1)	86.275mA
PR6: I(R2)	34.510mA
PR7: I(R3)	43.922mA
PR8: I(R4)	76.863mA

c.) Compare with theoretical values.

ASSIGNMENT - 1 (U19CS012)

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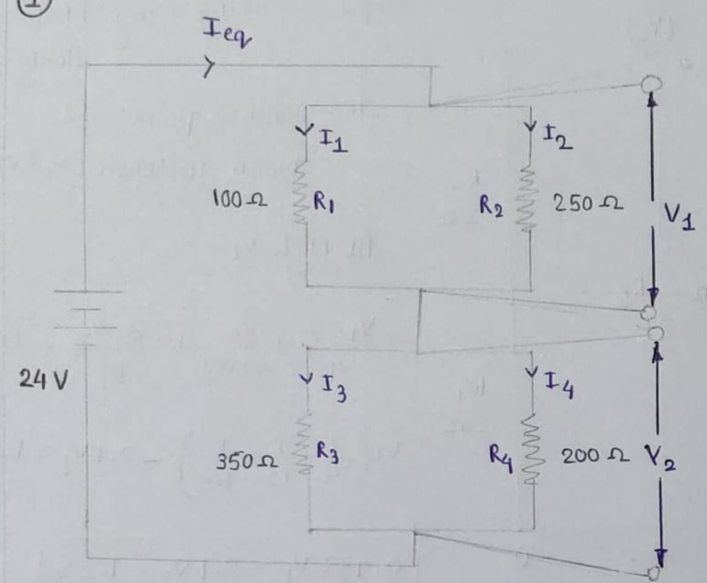


Step 1 : $R_{eq} = \left(\frac{R_1 \times R_2}{(R_1 + R_2)}\right) + \left(\frac{R_3 \times R_4}{R_3 + R_4}\right) \Omega$

$R_{eq} = \left(\frac{250 \times 100}{350} + \frac{350 \times 200}{550}\right) \Omega$

$= 71.4286 + 127.\overline{27} \ \Omega$

$\doteq 198.7013 \ \Omega$

$\simeq 198.7 \ \Omega$

Step 2 : $I_{eq} = \frac{V}{R_{eq}} = \frac{24 \text{ V}}{198.7 \ \Omega}$

$= 0.120785 \text{ A}$

$= 120.785 \text{ mA}$

Step 3 : Parallel

$V_1 = I_1 R_1 \ -(i) \qquad V_1 = I_2 R_2 \ -(ii)$

$\therefore I_1 R_1 = I_2 R_2 \ - (1)$

$I_1 + I_2 = I_{eq} \ - (2)$

Derivation (Just for info)

$I_1 = I_{eq} - \left(\frac{I_1 R_1}{R_2}\right) \Rightarrow I_1\left(1 + \frac{R_1}{R_2}\right) = I_{eq} \Rightarrow \left[I_1 = \frac{I_{eq}(R_2)}{R_1 + R_2}\right]$

Similarly $\left[I_2 = \frac{I_{eq}(R_1)}{(R_1 + R_2)}\right]$

$I_1 = \frac{(I_{eq}) R_2}{(R_1 + R_2)} = \frac{(120.785) \text{ mA} \times (250)}{(350)} = \boxed{86.275 \text{ mA}}$

$I_2 = \frac{(I_{eq}) R_1}{(R_1 + R_2)} = \frac{(120.785) \text{ mA} \times (100)}{(350)} = \boxed{34.51 \text{ mA}}$

$V_1 = I_1 R_1 = (86.275 \times 10^{-3} \text{ A}) \times (100 \ \Omega) = \boxed{8.6275 \text{ V}}$

Similarily;

$I_3 = \frac{(I_{eq}) R_4}{(R_3 + R_4)} = (120.785) \text{ mA} \times \left(\frac{200}{550}\right) = 43.9218 \text{ mA} \approx \boxed{43.922 \text{ mA}}$

$I_4 = \frac{(I_{eq}) R_3}{(R_3 + R_4)} = (120.785) \text{ mA} \times \left(\frac{350}{550}\right) = \boxed{76.8632 \text{ mA}}$

$V_2 = I_3 \times R_3 = (43.922 \times 10^{-3}) \text{ A} \times 350 \ \Omega = 15.3727 \text{ V} \approx \boxed{15.373 \text{ V}}$

d.) Final Result and Conclusion

Resistor	Voltage (V)		Current (mA)	
	Multism	Theoretical	Multism	Theoretical
R1	8.6275	8.6275	86.275	86.275
R2	8.6275	8.6275	34.51	34.51
R3	15.373	15.373	43.922	43.922
R4	15.373	15.373	76.863	76.8632

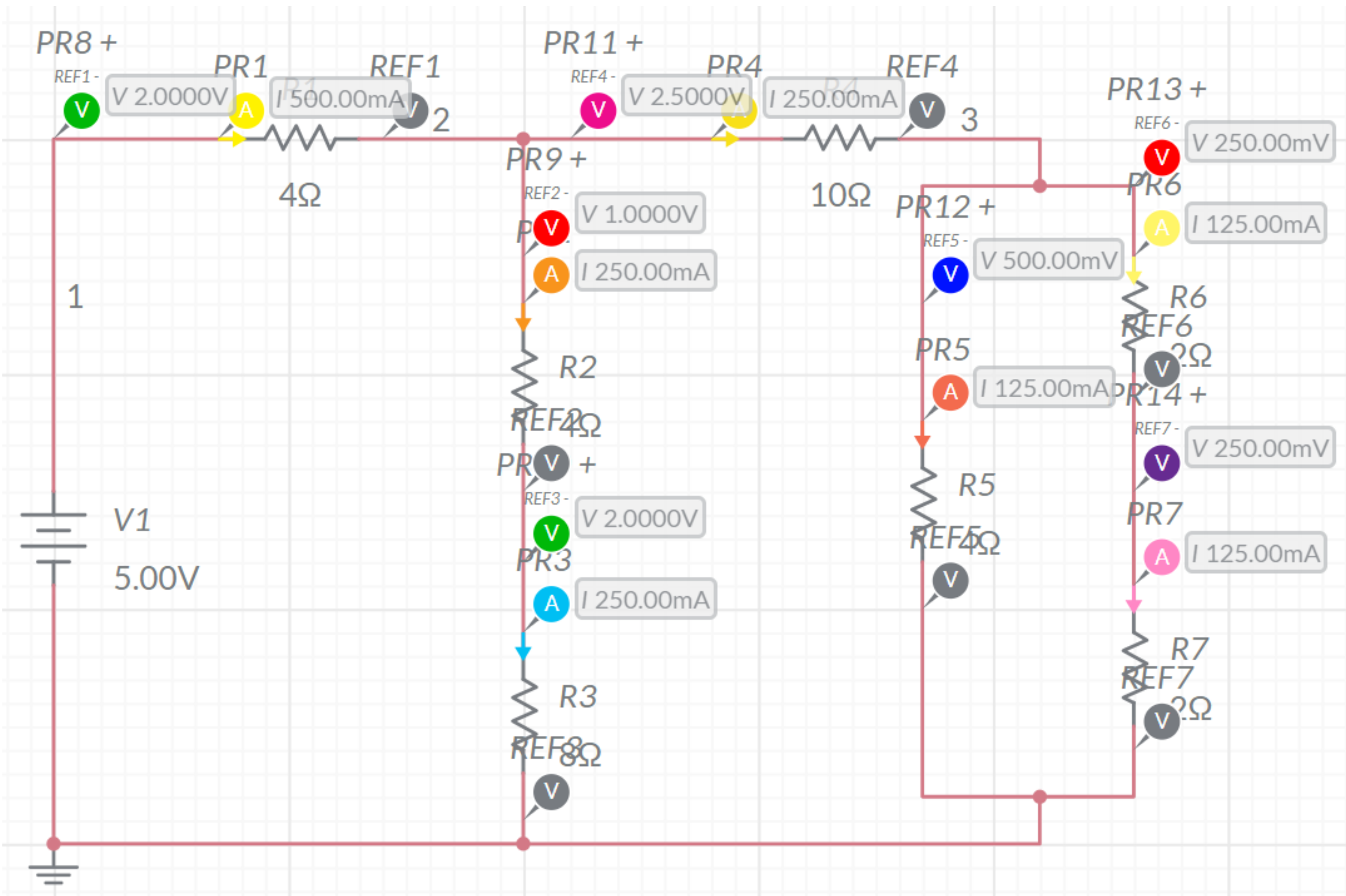
Conclusion:

We can observe from Above Table, Both the *Theoretical* and *Multisim* Values of Current and Voltage are **Equal**.

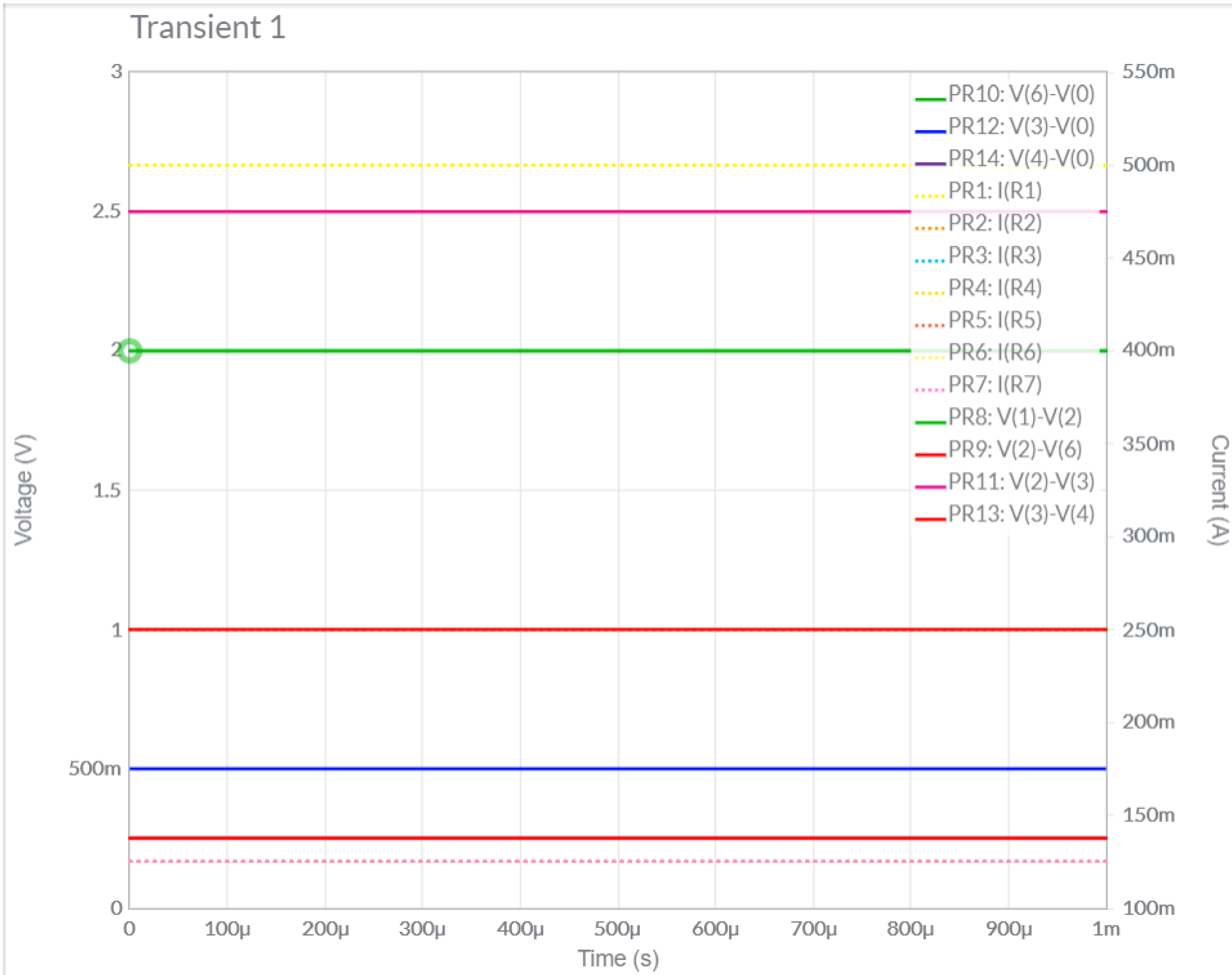
Hence, Experiment is Performed Successfully (without any Error).

Assignment -2

a.) Implement the circuit as shown in Figure in Multisim online.



b.) Evaluate the current and voltage across each resistor using simulator.

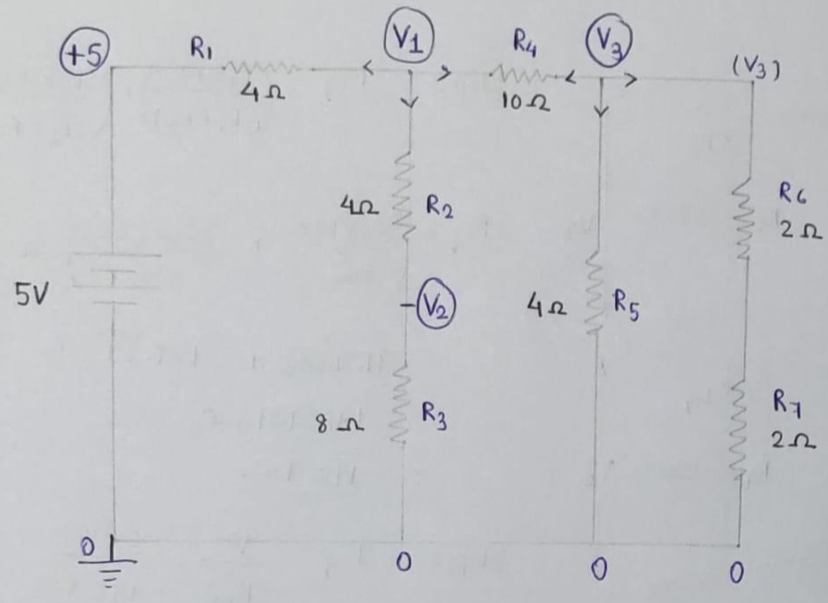


DC OP 1

Signal	Value
PR10: V(6)-V(0)	2.0000V
PR12: V(3)-V(0)	500.00mV
PR14: V(4)-V(0)	250.00mV
PR1: I(R1)	500.00mA
PR2: I(R2)	250.00mA
PR3: I(R3)	250.00mA
PR4: I(R4)	250.00mA
PR5: I(R5)	125.00mA
PR6: I(R6)	125.00mA
PR7: I(R7)	125.00mA
PR8: V(1)-V(2)	2.0000V
PR9: V(2)-V(6)	1.0000V
PR11: V(2)-V(3)	2.5000V
PR13: V(3)-V(4)	250.00mV

c.) Compare with theoretical values.

ASSIGNMENT - 2 (U19CS012)



Step 1: Solving using Node Analysis

Two Junction points as shown in figure (V_1 & V_3)

At Node V_1

$$\frac{V_1-5}{4}+\frac{V_1}{(4+8)}+\frac{V_1-V_3}{10}=0$$

$$V_1\left(\frac{1}{4}+\frac{1}{12}+\frac{1}{10}\right)-0.1V_3=1.25$$

$$\boxed{0.433V_1-0.1V_3=1.25}$$ Eqn (1)

Step 2: At Node V_3:

$$\frac{V_3-V_1}{10}+\frac{V_3}{4}+\frac{V_3}{(2+2)}=0$$

$$V_3(0.6)-0.1V_1=0$$

$$\boxed{V_1=6V_3} \longrightarrow \text{Eq}^n\ (2)$$

$$V_3(0.433\times 6-0.1)=1.25$$

$$V_3=0.5004\ V$$

$$\boxed{V_3\simeq 0.5V}$$

$$\boxed{V_1=3V}$$

Across Resistor	Voltage (Volt)	Current
R_1	$5-V_1=\boxed{2V}$	$I_{R_1}=\frac{V_{R_1}}{(R_1)}=\frac{2V}{4\Omega}=0.5A=\boxed{500\ mA}$
R_2	$V_{R_2}=I_{R_2}\times R_2=(0.25A)\times 4\Omega=\boxed{1V}$	$I_{R_2}=\frac{V_1}{(R_2+R_3)}=\frac{3}{12}=0.25A=\boxed{250\ mA}$
R_3	$V_{R_3}=I_{R_3}\times R_3=0.25(A)\times 8(\Omega)=\boxed{2V}$	$I_{R_3}=I_{R_2}=0.25A=\boxed{250\ mA}$
R_4	$V_{R_4}=V_1-V_3=\boxed{2.5V}$	$I_{R_4}=\frac{V_{R_4}}{R_4}=\frac{2.5V}{10\Omega}=\boxed{250\ mA}=0.25A$
R_5	$V_{R_5}=V_3=\boxed{0.5V}$	$I_{R_5}=\frac{V_{R_5}}{R_5}=\frac{0.5}{4}=0.125A=\boxed{125\ mA}$
R_6	$V_{R_6}=I_{R_6}\times R_6=\boxed{0.25V}$	$I_{R_6}=V_3/(R_6+R_7)=\frac{0.5}{4}=\boxed{125\ mA}$
R_7	$V_{R_7}=I_{R_7}\times R_7=\boxed{0.25V}$	$I_{R_7}=I_{R_6}=\boxed{125\ mA}$

d.) Final Result and Conclusion

Resistor	Voltage (V)		Current (mA)	
	Multism	Theoretical	Multism	Theoretical
R1	2	2	500	500
R2	1	1	250	250
R3	2	2	250	250
R4	2.5	2.5	250	250
R5	0.5	0.5	125	125
R6	0.25	0.25	125	125
R7	0.25	0.25	125	125

Conclusion:

We can observe from Above Table, Both the *Theoretical* and *Multisim* Values of Current and Voltage are **Equal**.

Hence, Experiment is Performed Successfully (without any Error).

Submitted By:
Roll Number: U19CS012 (D-12)
Name: Bhagya Rana