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Time : Date : / /

Name : Tanjim Reza

Student ID: 20101065

Course : CSE250

Section : CSE06

Lab Assignment : 03

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Name of the Experiment: Verification of KCL and KVL

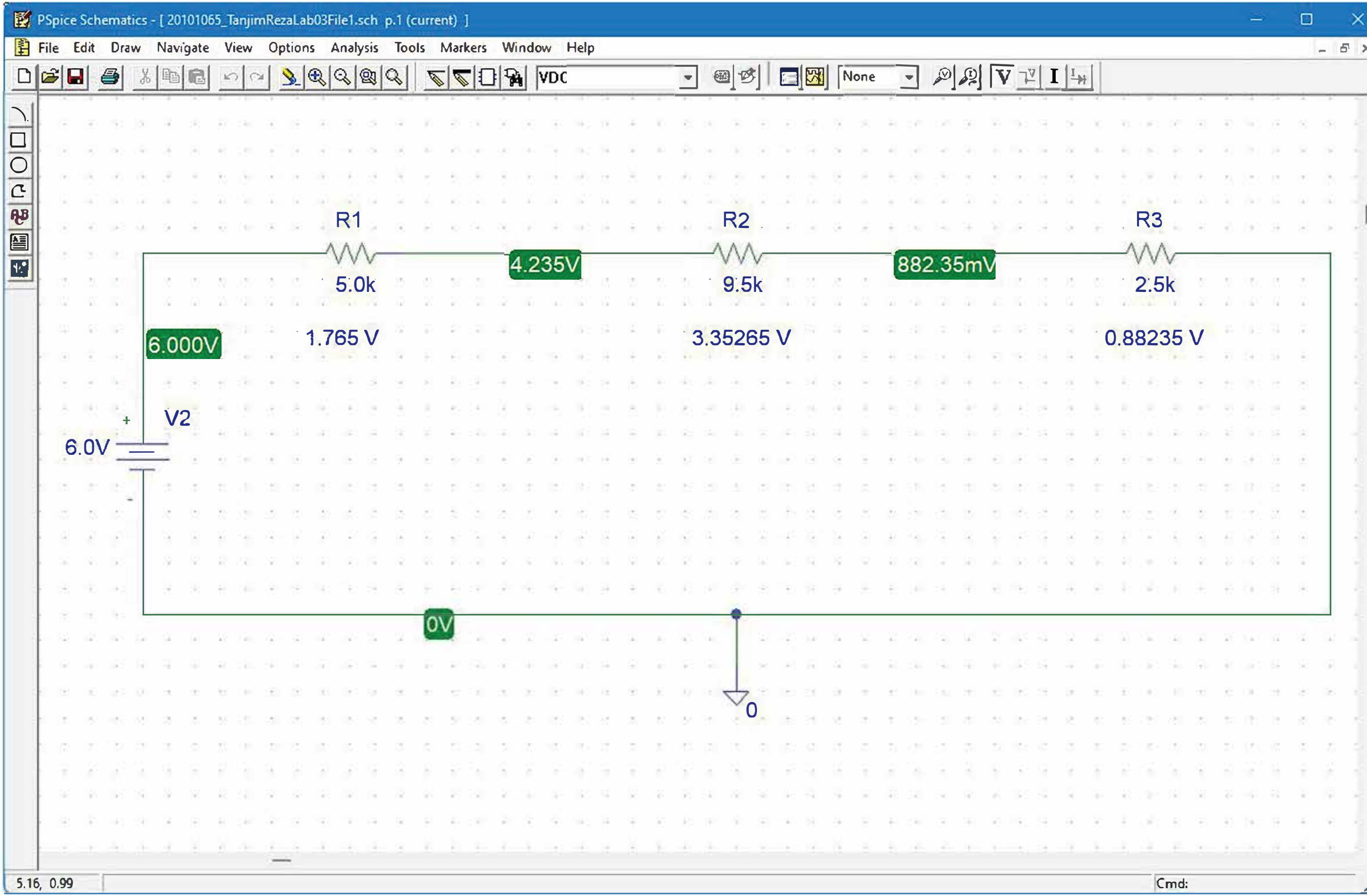
KVL

Objective: This experiment is intended to verify Kirchhoff's voltage law (KVL) with the help of series circuits.

Theory: KVL states that around any closed circuit the algebraic sum of the voltage rises equals the algebraic sum of the voltage drops

Apparatus: DC voltage source, Resistors, Ammeter and voltmeter.

Circuit/System Diagram:


PSpice Schematics - [20101065_TanjimRezaLab03File1.sch p.1 (current)]
File Edit Draw Navigate View Options Analysis Tools Markers Window Help
VDC
None
R1
R2
R3
4.235V
882.35mV
5.0k
9.5k
2.5k
6.000V
1.765 V
3.35265 V
0.88235 V
V2
6.0V
0V
0
5.16, 0.99
Cmd:

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Result/Analysis :

Given,

$$R_1 = 5k\Omega$$

$$R_2 = 9.5\ k\Omega$$

$$R_3 = 2.5\ k\Omega$$

$$V_A = 6.0\ V$$

R_1, R_2, R_3 are connected in series.

$$\therefore R_{123} = (5 + 9.5 + 2.5) = 17\ k\Omega$$

Now, as all the resistors are in series, the current throughout the circuit will be constant

$$\therefore I = \frac{V}{R} = \frac{V_A}{R_{123}}$$

$$= \frac{6\ V}{17\ k\Omega}$$

$$= \frac{6}{17}\ mA$$

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According to the circuit, voltage accross R_1, R_2, R_3 are V_1, V_2, V_3.

$$V_1 = IR_1 = \frac{6}{17} \times 5$$

$$= 1{\cdot}7647 \text{ V}$$

$$= 1{\cdot}765 \text{ V}$$

$$V_2 = IR_2 = \frac{6}{17} \times 9{\cdot}5 = 3{\cdot}352 \text{ V}$$

$$V_3 = IR_3 = \frac{6}{17} \times 2{\cdot}5 = 0{\cdot}882 \text{ V}$$

KVL verification Table:

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	V_A (V)	V_1 (v)	V_2 (V)	V_3 (v)	$V_1+V_2+V_3$ (V)
Simulation	5	9.5	2.5	6	1.765	3.35265	0.88235	6
Theoretical	5	9.5	2.5	6	1.765	3.352	0.882	5.999

Questions and Answers:

All bux input questions are answered in ~~Ret~~ Result part showing the calculations. I have considered 5.999V as 6 V.

And $V_1 + V_2 + V_3 = V$ this has been calculated and proved. (Combined discussion in the end)

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KCL

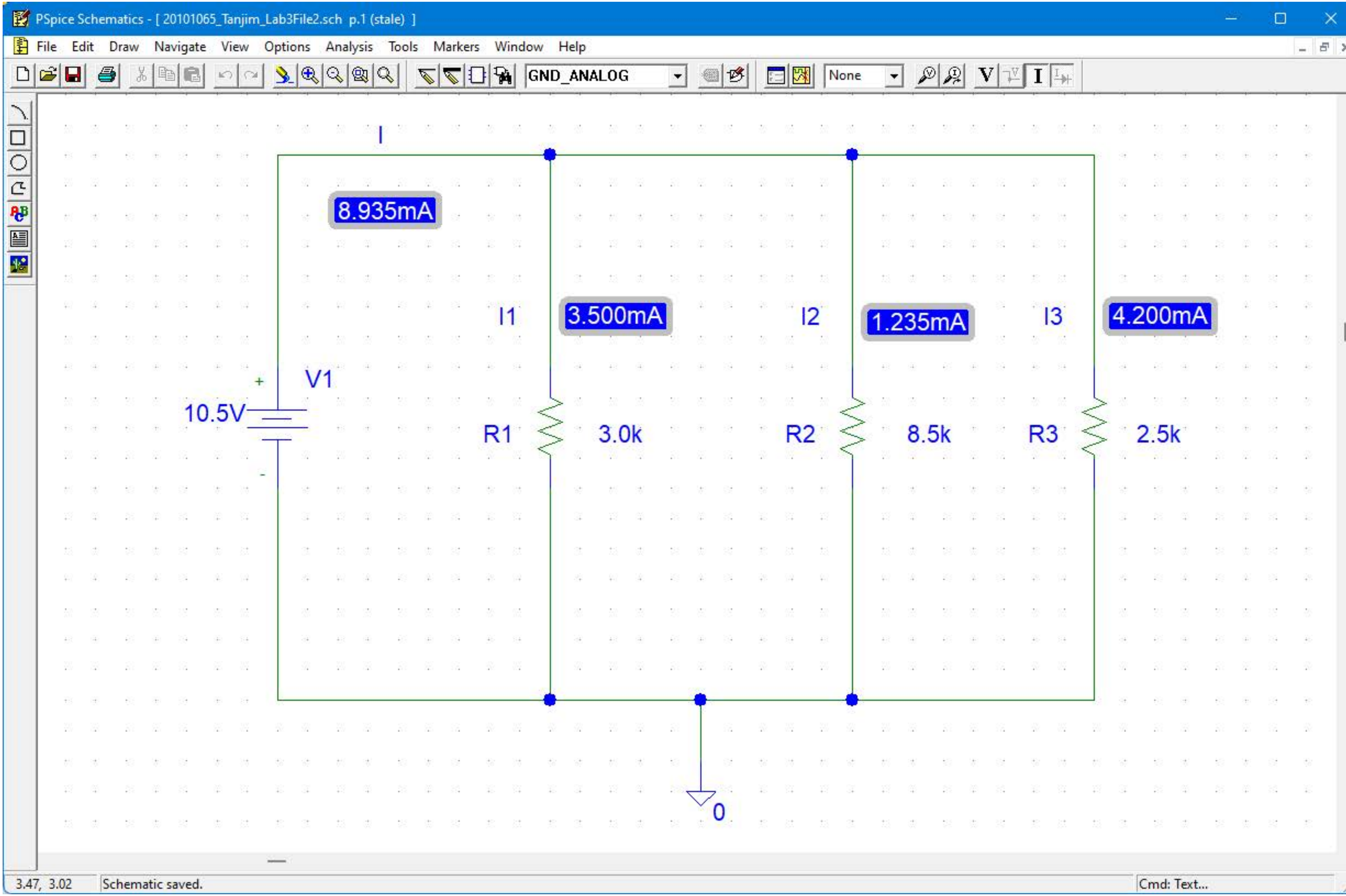
Objective: This experiment is intended to verify Kirchhoff's law (KCL) with the help of simple parallel circuit.

Theory:

KCL states that the algebraic sum of the currents entering any node equals the sum of the currents leaving the node.

Apparatus: DC Ammeter, Resistors, DC Power supply.

Circuit / System Diagram:


PSpice Schematics - [20101065_Tanjim_Lab3File2.sch p.1 (stale)]
File Edit Draw Navigate View Options Analysis Tools Markers Window Help
GND_ANALOG
None
I
8.935mA
I1
3.500mA
I2
1.235mA
I3
4.200mA
V1
10.5V
R1
3.0k
R2
8.5k
R3
2.5k
0
3.47, 3.02
Schematic saved.
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Result/Analysis:

Given,

$R_1 = 3\ k\Omega$

$R_2 = 8{\cdot}5\ k\Omega$

$R_3 = 2{\cdot}5\ k\Omega$

$V_A = 10{\cdot}5\ V$

R_1, R_2 and R_3 are in parallel connection

$$\therefore R_{123} = \left(\frac{1}{3} + \frac{1}{8{\cdot}5} + \frac{1}{2{\cdot}5}\right)^{-1}$$

$$= 1{\cdot}175115207$$

$$= 1{\cdot}1751\ k\Omega$$

We know, $V = IR$

$$\Rightarrow I = \frac{V}{R} = \frac{10{\cdot}5}{1{\cdot}1751}$$

$$= 8{\cdot}935\ mA$$

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$$\therefore I_1 = \frac{V_1}{R_1} = \frac{V}{3} = \frac{10.5}{3} = 3.5 \text{ mA}$$

$$I_2 = \frac{V}{R_2} = \frac{10.5}{8.5} = 1.2352 \text{ mA}$$

$$I_3 = \frac{V}{R_3} = \frac{10.5}{2.5} = 4.2 \text{ mA}$$

$$I_1 + I_2 + I_3 = (3.5 + 1.2352 + 4.2)$$
$$= 8.935 \text{ mA}$$
$$= I$$

KCL verification Table:

Observation	R_1 (kΩ)	R_2 (kΩ)	R_3 (kΩ)	I (mA)	I_1 (mA)	I_2 (mA)	I_3 (mA)	$I_1+I_2+I_3$ (mA)
Simulation	3	8.5	2.5	8.935	3.500	1.235	4.200	8.935
Theoretical	3	8.5	2.5	8.935	3.5	1.235	4.2	8.935

Questions and Answers:

Value of I, I_1, I_2, I_3 have been calculated theoretically and also in simulation.

$(I_1 + I_2 + I_3)$ for both cases exactly matches with I which is what we wanted.

Finally, for both KVL and KCL our experiment has successfully succeeded.

For KVL,

$$V_1 + V_2 + V_3 = V$$

For KCL,

$$I_1 + I_2 + I_3 = I.$$

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Discussions

The experiment proved the Law of KCL and KVL and the theoretical and simulated value were totally correct thereby verifies KVL and KCL