Lab Report

On

Verification of Kirchhoff's Current Law (KCL) using a current loop and current divider rule using hardware and digital simulation.

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Course Title: Electrical Circuit Lab

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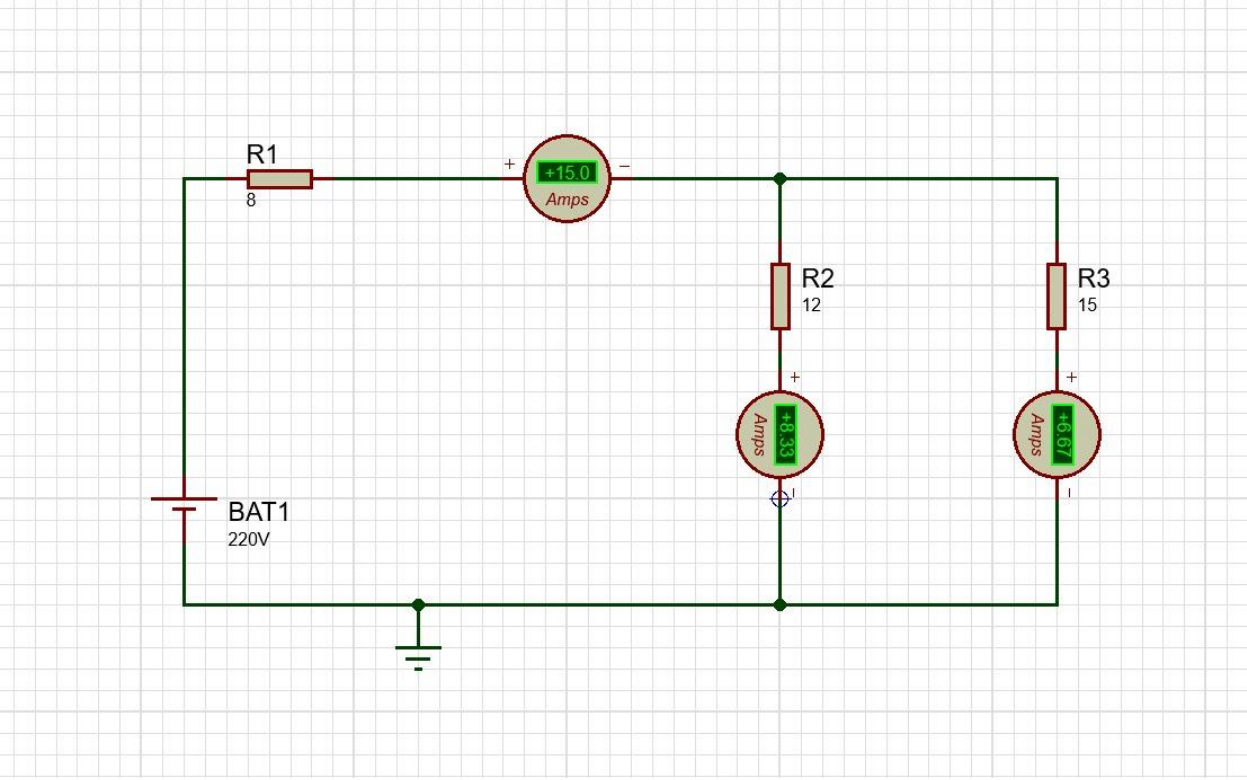
No. of Experiment : 02

Name of the Experiment : Verification of Kirchhoff's Current Law (KCL) using a current loop and current divider rule using hardware and digital simulation.

Objective : To verify Kirchhoff's Current Law (KCL) using digital simulation and practical experiments.

Theory : Kirchhoff's Current Law, The algebraic sum of currents at any junction of a system of conductors is zero.

Diagrams or Circuit Images :



Materials Required:

1. Software Used: Proteus Professional .
2. Ammeter .
3. Resistors .
4. Connection wires .
5. DC Power Supply .

Working Procedure:

1. Make the connections as shown in the circuit diagram using Proteus 8 professional.
2. Measure the current across each resistor using an ammeter.
3. Verify Kirchhoff's Law:
    - Build the KCL circuit on the beard board.
    - Measure the current flowing into and out of the nod using the ammeter.
    - Calculate the algebraic sum of currents at the junction.
    - Verify that the sum of currents is approximately zero.
    - Measure the total current through the parallel circuit.
    - Calculate the current in each branch.

<u>Calculation</u> :

We know ,

$$R = \left(\frac{1}{R2} + \frac{1}{R3}\right)^{-1} + R_1$$

$$= \left(\frac{1}{8} + \frac{1}{12}\right)^{-1} + 8$$

$$= 12.8\ \Omega$$

$R_1 = 8\ \Omega$

$R_2 = 12\ \Omega$

$R_3 = 15\ \Omega$

Now , for , V=220 v ,

$I_{total} = \frac{V}{R} = \frac{220}{12.8} = 17.18$ A

Using current divider law :

$I_1 = \frac{R2}{R2+R3} I$

$= \frac{12}{12+15} * 17.18$

$=7.63$ A

$I_2 = \frac{R3}{R2+R3} I$

$= \frac{15}{12+15} * 17.18$

$= 9.54$ A

$I = I_1 + I_2 = 7.63 + 9.54 = 17.17$ A $= I_{total}$

Similarly,

for V= 100 v ,

$I_{total} = \frac{V}{R} = \frac{100}{9.12} = 10.96$ A

Using current divider law :

$I_1 = \frac{R2}{R2+R2} I$

$= \frac{7}{10+7} * 10.96$

$=4.52$ A

$I_2 = \frac{R3}{R2+R2} I$

$= \frac{10}{7+10} * 10.96$

$= 6.45$ A

$I = I_1 + I_2 = 4.52 + 6.45 = 10.97$ A $= I_{total}$

Table :

SL. No	Input supply Voltage (v)	I_1(A)	I_2(A)	Total current I(A), measurement	Total current I(A), Theoretical
1	120	9.94	14.2	24.1	24.1
2	100	4.52	6.45	10.97	10.97
3	150	6.77	9.68	16.5	16.5
4	220	7.63	9.54	17.18	17.18

Working Procedure:

1. Assuming the current flowing through each resistor as I_1, I_2 and I_3
2. Assuming the direction of current flowing through each branch.
3. Measuring the current flowing into the top node of the circuit from each of the three branch.
4. Recording these current flowing.
5. Then add the three currents is zero or close to zero or sum of incoming Current is equal to the sum of outgoing current.

Result and Discussion :

1. The sum of current (measured) is 17.18 A and current (theoretical) is 17.18 A we have compared the measured values with the theoretical results the measured value are a little deviated from the theoretical values for calculation on data entry. Thus the KCL is verified successfully.

Conclusion:

At a node sum of incoming current, hence Kirchhoff's current law is verified.