EXPERIMENT NO. 4

DEMONSTRATION OF KIRCHHOFF'S VOLTAGE AND KIRCHHOFF'S CURRENT LAWS

OBJECTIVE:

To verify the following circuit using KCL & KVL

a) Express I as a function of V and R.
b) Express V as a function of I and R.
c) Demonstration of KVL
d) Demonstration of KCL

EQUIPMENTS REQUIRED:

- Variable DC power supply
- DMM (Digital Multi Meter)
- Resistors with different Resistances
- Breadboard

THEORY:

KIRCHHOFF"S VOLTAGE LAW

According to Kirchhoff's Voltage Law

"The sum of all voltages in a closed loop is equal to zero"

Mathematically,

$$\sum V_{All} = 0 \qquad (i)$$

Alternatively, in a closed loop the sum of all voltage rises is equal to the sum of all voltage drops

$$\sum V_{Rise} = \sum V_{Drop} \qquad (ii)$$

We can also say that voltage drops across each resistor in a close loop must be equal to the applied voltages.

CIRCUIT DIAGRAM

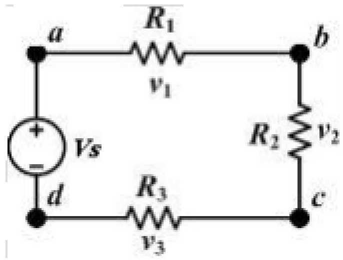

Figure 3.4 (**Circuit for Kirchhoff's Voltage Law)**

Applying KVL to the circuit above

$$-Vs + V_1 + V_2 + V_3 = 0$$
$$Vs = IR_1 + IR_2 + IR_3$$
$$I = V_s / R_{eq}$$

PROCEDURE

Measure the values of given Resistors and fill in the corresponding columns of Table. 4.1
Connect the circuit as shown in Figure above and set Vs. to 5 V
Calculate the values with the formulas provided in theory section of this experiment and fill the corresponding row in Table 7.2
Measure V1 , V2 and V3 and fill in corresponding Column in Table 7.2

RESULTS & CALCULATIONS

Table 4.3

R (Nominal)	R1 = kΩ	R2 = kΩ	R3= kΩ
R (Actual)			

Table 4.4

Value	V_1	V_2	V_3	$V_{1+} V_{2+} V_3$	V_s
Measured					
Calculated					

KIRCHHOFF CURRENT LAW

According to Kirchhoff‟s current law

> ***"The algebraic sum of all currents entering a node is equal to the sum of all the currents leaving a node"***

Mathematically, $\sum I_{Enter} = \sum I_{Leave}$ (iii)

Alternatively, the sum of all currents in a junction is equal to zero

Mathematically, $\sum I_{All} = 0$ (*iv*)

CIRCUIT DIAGRAM

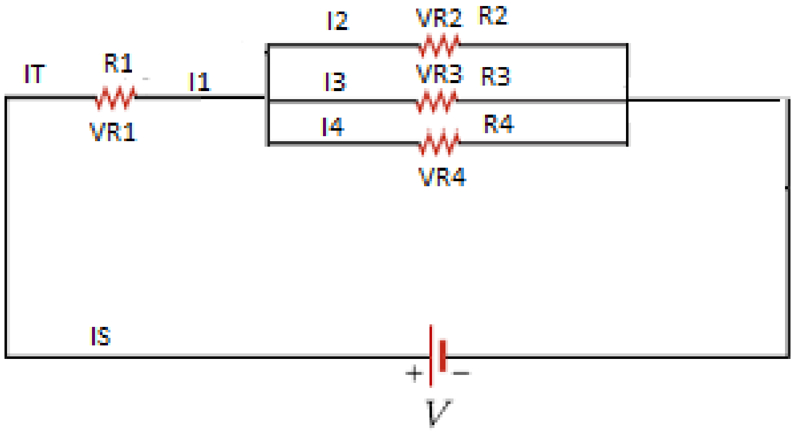

Figure 3.4 (**Circuit for Kirchhoff's Current Law)**

Select:: R_1 = ______ kΩ, R_2 = ______kΩ and R_3 = ______ kΩ R_4 = ______ kΩ
In the Figure 3.4 , the sum of current I_{R2}, I_{R3} and I_{R4} is equal to the I_{R1} or total supply current I_{in} or I_S or I_T.

PROCEDURE

1. On the breadboard connect the resistors in parallel configuration as shown in Figure 4.4

2. Connect the positive lead (Red wire) of the power supply to the open terminal of the one of the resistors.

3. Connect the negative lead (Black wire) of the power supply to the second terminal of the same resistor.

4. Switch on the power supply and set the supply voltage at 5 volts.

5. Use the D.C. Ammeter mode of the multi-meter with appropriate range as preset.

6. Connect Ammeter in such a way that it forms a series connection with the resistor and measure the current flowing through the resistor.

7. Record the observation accordingly in the table 4.4

8. Rearrange the circuit to measure the currents in table 4.4

RESULTS & CALCULATIONS

Sr. No.	Observation	Calculated [mA]	Measured [mA]
1	I_1		
2	I_2		
3	I_3		
4	I_4		
5	I_T or I_S		

DISCUSSION AND CONCLUSION

Evaluation Chart

	Total Marks	Obtained Marks
Participation in the Lab	3	
Accuracy of Results Obtained	4	
Viva	3	
Total	10	

Comments from Lab Instructor:

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Date Instructor’s Signature