University of engineering & technology Peshawar

Circuit & system-1

Lab report # 5

Fall 2020

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Section: B

Reg No: 19PWCSE1795

Semester: 2nd

Submitted to:

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1. Objectives:

After studding this lab we will be able,

- To know about kerchief voltage law.
- To know about its mathematical expression.
- To know about verification of kerchief voltage law by using breadboard.
- To know about application of kerchief voltage law.
- To apply series circuits principles.
- To apply KVL to a series circuit.
- To review single and double subscript voltage notation.
- To apply the voltage divider principle.
- To gain experience in designing resistive networks.

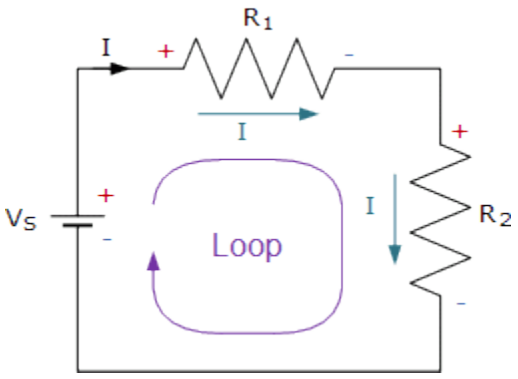
2. Kerchief's voltage law:

- **Kerchief voltage law is also known as law of conservation of energy.**
- KVL depends upon the concept of a loop.
- A loop is any closed path through the circuit which encounters no node more than once. Essentially, to create a loop, start at any node in the circuit and trace a path through the circuit until you get back to your original node.

Statement:

- Kirchhoff's **Voltage Law** or KVL, states that "in any closed loop network, the total **voltage** around the loop is equal to the sum of all the **voltage** drops within the same loop" which is also equal to zero.
- In other words the algebraic sum of all **voltages** within the loop must be equal to zero.

Circuit diagram:



Mathematical expression:

Mathematical expression of kvl for above circuit is,

$$V_S + (-IR_1) + (-IR_2) = 0$$

$$\therefore V_S = IR_1 + IR_2$$

$$V_S = I(R_1 + R_2)$$

$$V_S = IR_T$$

$$\text{Where: } R_T = R_1 + R_2$$

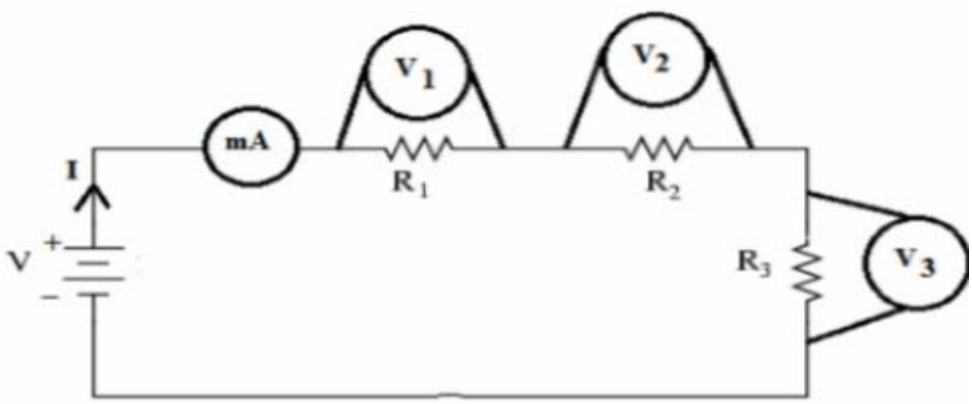
3. Apparatus:

- Breadboard
- Resisters
- Connecting wires
- Voltmeter
- Ammeter
- DC source

- Multimeter

4. Procedure:

- Construct the circuit on breadboard according to given circuit.



- Start the experiment from zero voltage of power supply. For zero supply voltage the current flow will be zero.
- Now increase voltage from 0v to 20v in at least five steps.
- For each step take voltmeter and ammeter reading and check for v=**v1+v2+v3.**
- Find R1, R2, R3 by using ohm meter and then algebraically add these three resistances.
- From the experimental reading find the eqvaulent resistance and then compare it with calculated value.

5. Observation and calculation:

DATA TABLE having different resisters and varying voltages.

S NO:	APPLIED VOLTAGE (V)	R1	R2	R3	CURRENT (I)	V_{exp} =IR1+IR2+1R3	%ERROR
1	10V	2	5	7	0.71	9.94	**0.06**
2	12V	5	8	10	0.521	11.983	**0.017**
3	15V	12	6	9	0.555	14.985	**0.014**
4	18V	10	14	22	0.391	17.986	**0.014**
5	20V	5	7	12	0.833	19.992	**0.008**

Data table having same resisters and varying voltages.

S NO:	APPLIED VOLTAGE (V)	R1	R2	R3	CURRENT(I)	V_{exp} =IR1+IR2+1R3	%ERROR
1	10V	10	10	10	0.333	9.99	**0.01**
2	12V	15	15	15	0.267	12.015	**-0.015**
3	15V	12	12	12	0.416	14.976	**0.024**
4	18V	5	5	5	1.2	18	**0**
5	20V	6	6	6	1.11	19.98	**0.02**

6. Analysis:

We have seen here that Kirchhoff's voltage law, KVL is Kirchhoff's second law and states that the algebraic sum of all the voltage drops, as you go around a closed circuit from some fixed point and return back to the same point, and taking polarity into account, is always zero.

That is $\Sigma V = 0$

The theory behind Kirchhoff's second law is also known as the law of conservation of voltage, and this is particularly useful for us when dealing with series circuits, as series circuits also act as voltage dividers and the voltage divider circuit is an important application of many series circuits.

From above data table we also analyzed that equivalent resistance in series is equal to sum of all individual resistances PRESET in the circuit.

I,e $R_{eq} = R1+R2+R3$

The end