DEPT. OF ELECTRICAL & ELECTRONICS ENGINEERING

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, Kattankulathur – 603 203

Title of Experiment	: **1. Verification of Kirchhoff's Laws**
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Register Number	: RA2111050010001
Date of Experiment	: 24/09/2021

Sl. No.	Marks Split up	Maximum marks (15)	Marks obtained
1	Pre Lab questions		
2	Preparation of observation		
3	Execution of experiment		
4	Calculation / Evaluation of Result		
5	Post Lab questions		
Total		**15**	

Staff Signature

PRE LAB QUESTIONS

1. Define Ohm's law.

Ohm's law states that the current through a conductor between two points is directly proportional to the voltage across the two points.

2. State KCL and KVL.

The KVL states that the algebraic sum of the voltage at node in a closed circuit is equal to zero. The KCL law states that, in a closed circuit, the entering current at node is equal to the current leaving at the node.

3. Define ideal and practical current and voltage sources.

The ideal current source provides exactly the same current to any load resistance and doesn't change its current with changing a load resistance.
Pratical current sources change their current by changing the load resistance due to the internal resistance in it.
A voltage source is a two-terminal device which can maintain a fixed voltage.

4. What is the difference between active and passive elements?

Active components are the elements or devices which are capable of providing or delivering energy to the circuit. Passive components are the ones that do not require any external source for the operation and are capable of storing energy in the form of voltage or current in the circuit.

5. What is a loop and node?

A loop is any sequence of elements connected between nodes that starts and ends at the same node.
A node is the point where two or more branches are connected together.

Experiment No. 1 Date :	VERIFICATION OF KIRCHOFF'S LAWS

Aim:

To verify Kirchhoff's current law and Kirchhoff's voltage law for the given circuit.

Apparatus Required:

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-30 V)	2
2	Resistance	330 Ω, 220 Ω 1kΩ	6
3	Ammeter	(0-30 mA)MC	3
4	Voltmeter	(0-30 V)MC	3
5	Bread Board & Wires	--	Required

Statement:

KCL: The algebraic sum of the currents meeting at a node/junction is equal to zero.

KVL: In any closed path / mesh, the algebraic sum of all the voltages is zero.

Precautions:

1. Voltage control knob should be kept at minimum position.
2. Current control knob of RPS should be kept at maximum position.

Procedure for KCL:

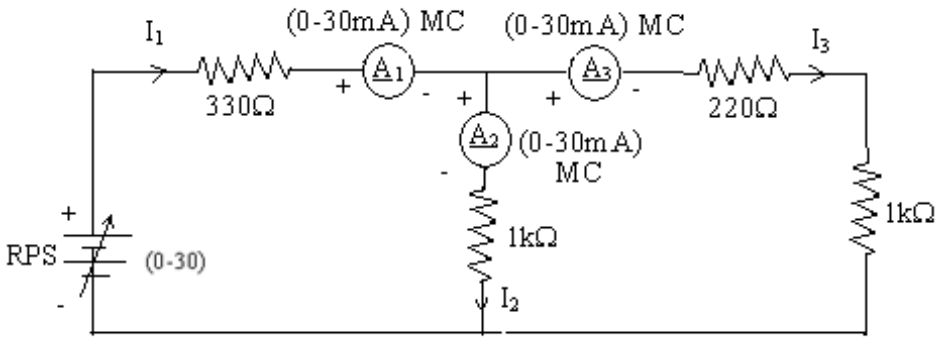
1. Give the connections as per the circuit diagram.
2. Set a particular value of voltage (refer table) in RPS using voltage control knob
3. Note down the corresponding ammeter reading
4. Repeat the same for different voltages

Procedure for KVL:

1. Give the connections as per the circuit diagram.
2. Set a particular of voltage (refer table) in RPS.
3. Note all the voltage reading
4. Repeat the same for different voltages

HARDWARE SETUP:

Circuit for KCL verification:



KCL - Theoretical Values:

Sl. No.	Voltage E	Current			$I_1 = I_2 + I_3$
		I_1	I_2	I_3	
	Volts	mA	mA	mA	mA
1	10	11.37	5.12	6.25	11.37
2	20	22.74	12.5	10.24	22.74
3	25	28.42	15.62	12.8	28.42

KCL - Practical Values:

Sl. No.	Voltage E	Current			$I_1 = I_2 + I_3$
		I_1	I_2	I_3	
	Volts	mA	mA	mA	mA
1	10	11.37	5.12	6.25	11.37
2	20	22.74	12.5	10.24	22.74
3	25	28.42	15.62	12.8	28.42

Model Calculations:

KCL Circuit

$$I_1 = I_2 + I_3$$

$$\frac{10 - V_1}{330} = \frac{V_1}{1000} + \frac{V_1}{1220}$$

$$\frac{1}{33} - \frac{V_1}{330} = \frac{V_1}{1000} + \frac{V_1}{1220}$$

$$0.030 = 0.001V_1 + 0.0008V_1 + 0.003V_1$$

$$V_1 = 6.25\ V$$

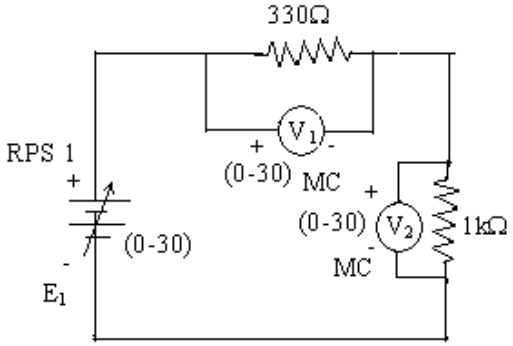
$$I_1 = \frac{10 - 6.25}{330} = \frac{3.75}{330} = 0.01\ A\ mA = 11.37\ mA$$

$$I_2 = \frac{6.25}{1000} = 6.25\ mA$$

$$I_3 = \frac{6.25}{1220} = 5.12\ mA$$

$$\boxed{I_1 = I_2 + I_3}$$

Circuit for KVL verification:



KVL – Theoretical Values

Sl.No.	RPS	Calculated voltage values		KVL
	E_1	V_1	V_2	$E_1 = V_1 + V_2$
	V	V	V	V
1	10	2.48	7.52	10
2	20	4.96	15.04	20
3	25	6.2	18.8	25

KVL - Practical Values

Sl.No.	RPS	Voltmeter reading		KVL
	E_1	V_1	V_2	$E_1 = V_1 + V_2$
	V	V	V	V
1	10	2.48	7.52	10
2	20	4.96	15.04	20
3	25	6.2	18.8	25

Model Calculations:

KVL

Acc to loop one

$10 = 330I + 1000I$

$10 = I(1330)$

$I = \frac{10}{1330}$

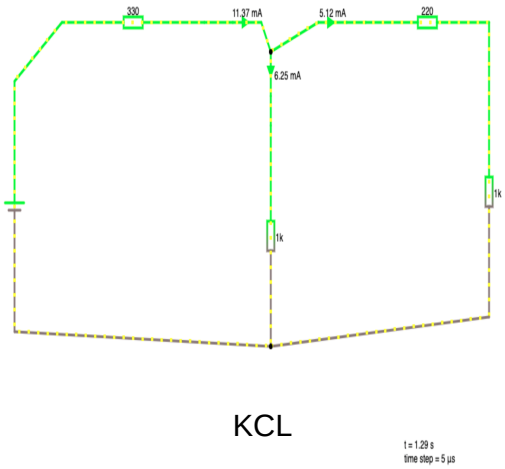
$\boxed{I = 0.0075}$

$V_1 = 330 \times 0.0075 = 2.475$

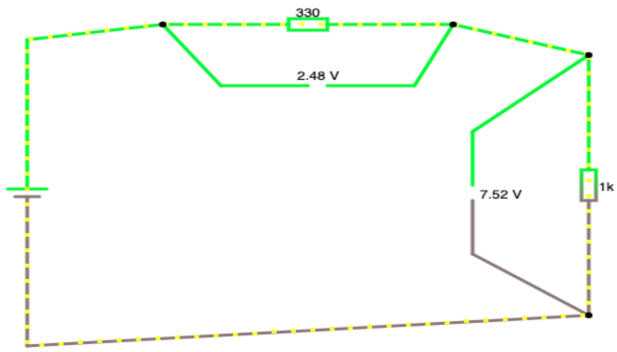
$V_2 = 1000 \times 0.0075 = 7.5$

$\boxed{V_E = V_1 + V_2}$

e- Circuit Simulation outputs:



KCL



KVL

Result:

The following experiment therefore verifies Kirchoff's law.

POST LAB QUESTIONS

1) Define resistance.

Resistance is a measure of the opposition to current flow in an electrical circuit.

2) Express the limitations of Ohm's law?

The limitation of Ohm's law is that the law is not applicable to unilateral networks.

3) What is the unit for V, I, R, L and C?

Unit of V is Voltage
Unit of R is Ohm
Unit of I is Ampere
Unit of L is Henry
Unit of C is Farad

4) Compare series and parallel circuits

In a series circuit, the same amount of current flows through all the components placed in it. On the other hand, in parallel circuits, the components are placed in parallel with each other due to which the circuit splits the current flow.

5) What is the difference between series and parallel connection of batteries?

In a series connection, batteries of like voltage and amp-hour capacity are connected to increase the voltage of the overall assembly.
In a parallel connection, batteries of like voltages and capacities are connected to increase the capacity of the overall assembly.