North South University

Department of Electrical & Computer Engineering

LAB REPORT

Course Name: EEE141L

Section: 08

Lab No: 01

Experiment Number: 01 & 02

Lab Name: Ohm's Law, KVL, and Voltage Divider Rule using Series Circuit

Experiment 01 Name: Verification of Ohm's Law
Experiment 02 Name: Series Circuit

Experiment Date: 12 June, 2022 and 19 June, 2022

Report Submission Date: 26 June, 2022

Group Number: 04

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Remarks:	

Experiment Name:

Verification of Ohm's Law

Objective:

(1) We have to find the resistance of a resistor from its color code.

(2) We have to measure voltage, current and resistance values using a digital Multimeter.

(3) We have to verify the validity of Ohm's Law.

(4) We have to test the voltage divider rule in a series circuit.

List of Equipment:

(1) Bread Board

(2) DC power source

(3) Resistors ($3.3K\Omega$, $5.6K\Omega$)

(4) Digital Multimeter (DMM)

(5) Connecting Wire.

Theory:

Ohm's law states that the electrical current flowing through any conductor is directly proportional to the potential difference between its ends, assuming the physical conditions of the conductor do not change. In other words, the ratio of potential difference between any two points of a conductor to the current flowing between them is constant, provided the physical conditions do not change. Mathematically, Ohm's law can be expressed,

$$I \propto V$$

which with the constant of proportionality, the resistance R in the above equation,

$$I = \frac{V}{R}$$

$$\text{or, } V = IR$$

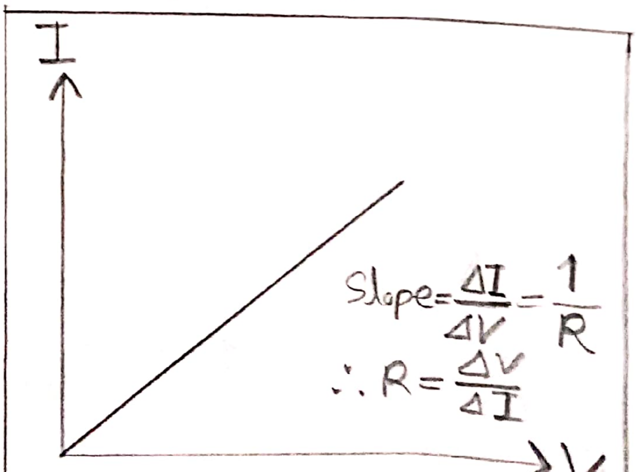

Fig: Ohm's law

Here,

V = voltage

I = current

R = resistance

Ohm's law can be verified if we manage to show that for a given conductor the ratio of voltage and current is constant. Resistance of the conductor is a constant for a known temperature range.

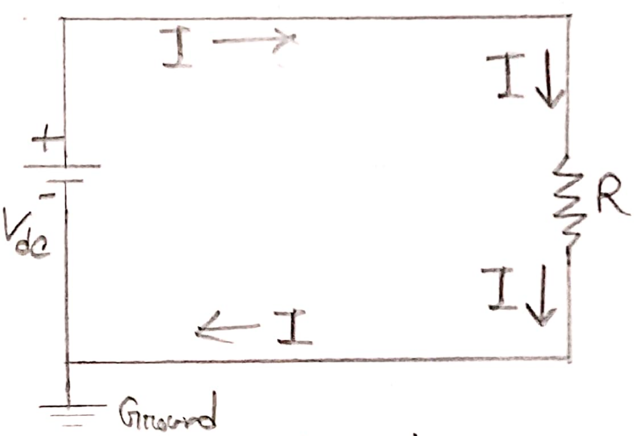

Fig: Ohm's Law

Ohm's law for resistance in series circuits, are sometimes called current-coupled or daisy chain-coupled. The current in a series circuit goes through every component in the circuit. Therefore all of the components in a series connection carry the same current. There is only one path in a series circuit in which the current can flow.

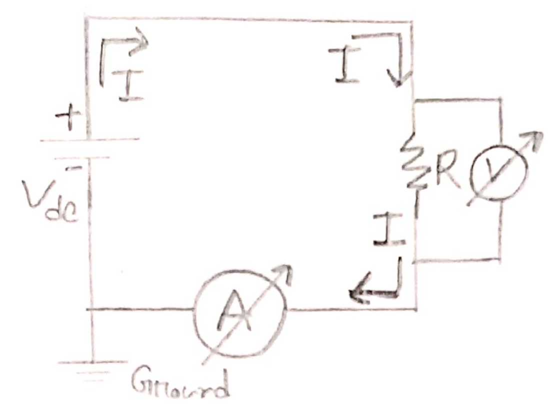

Fig: Ohms Law for Resistance in series

Resistor value, tolerance and wattage rating are generally printed onto the body of the resistor as number or letters when the resistors body is big enough to read the print, such as large power resistors. But when the resistor is small such as a 1/4 watt carbon or film type, these specificat-ions must be shown in some other manner as the print would be too small to read. So, The values are often indicated with color codes. The Coding is defined in the international standard IEC 60062.

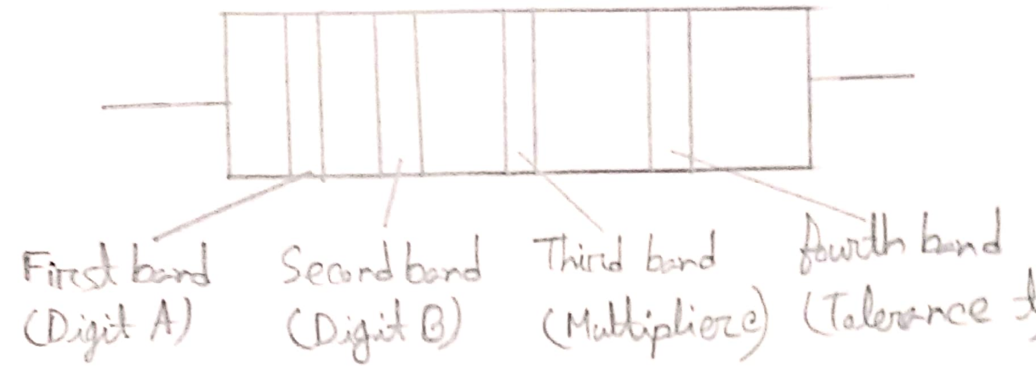

Fig : 4 band Resistor Code

In the figure, there are four colors and each color represents a number in the 4 band resistor. The order in which the colors are arranged, gives the values of resistor.

∴ Theoretical Resistance :

First band Second band (× Third band) ± Fourth band

= Digit(A) Digit(B) (× Multiplier(c)) ± tolerance(t)

We can measure resistance theoretically by using Ohm's law,

which is $V = IR$ or, $R = \frac{V}{I}$

we can also calculate from power, which is.

$P = VI = (IR)I = I^2R$ or, $P = I^2R$ or, $R = \frac{P}{I^2}$

Percentage error is the difference between approximate and exact value, as a percentage of the exact value. In other words, it is the difference between estimate-d value and the actual value in com-parison to the actual value and is expressed as a percentage.

$$\therefore \text{Percentage error} = \frac{|\text{Practical value} - \text{Theoretical value}|}{\text{Theoretical value}} \times 100$$

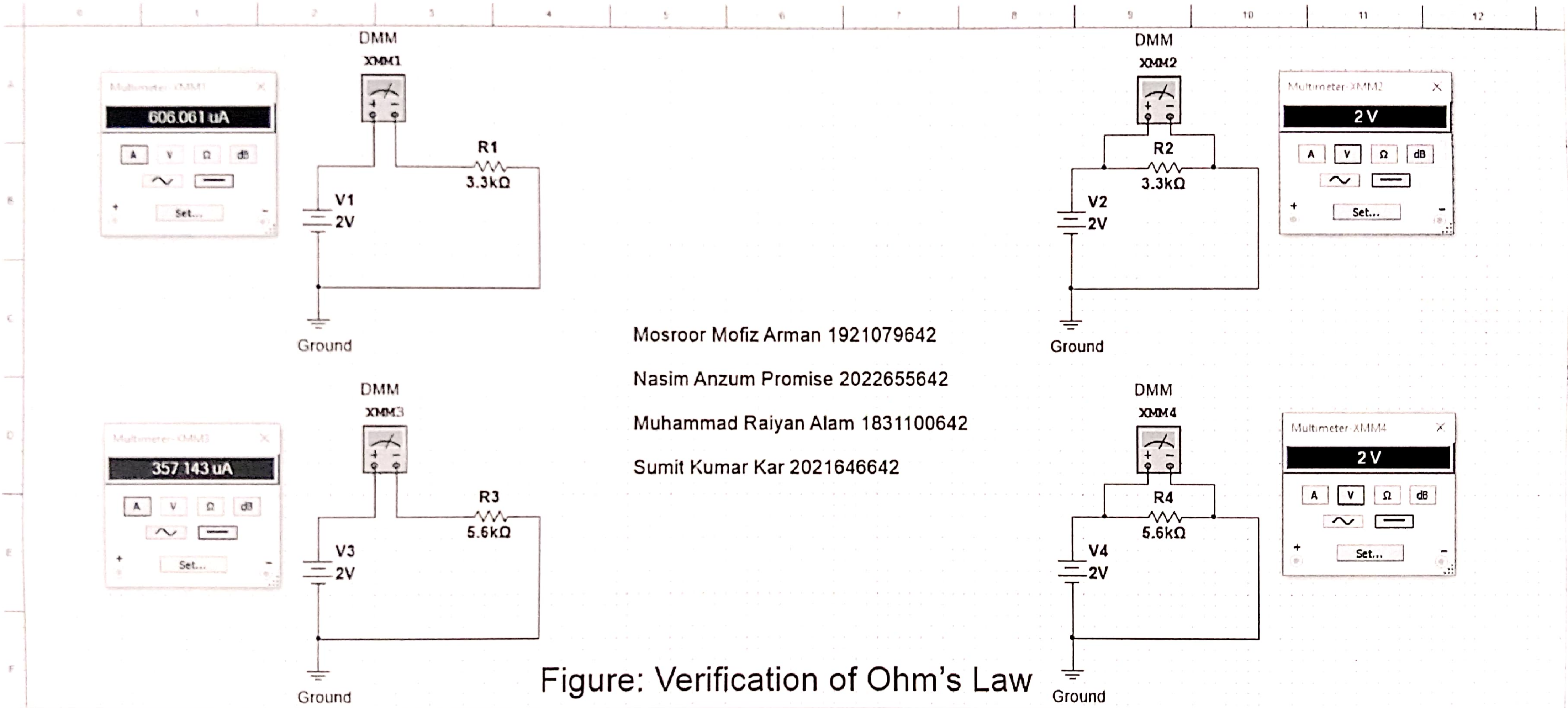

Figure: Verification of Ohm's Law

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Data Collection for Exp1:
Lab 1: Exp1
Group No. 4
Instructor's Signature

Please do all the calculations in 3 significant figures or 2 decimal places where applicable

Table 1:

Resistance using colour coding					Resistance using DMM	% Error
Band 1	Band 2	Band 3	Band 4	Resistance ± tol		
Orange (3)	Orange (3)	Red (100Ω)	Gold (±5%)	3.3KΩ ±5%	3.243 KΩ	1.73%
Green (5)	Blue (6)	Red (100Ω)	Gold (±5%)	5.6KΩ ±5%	5.553 KΩ	0.84%

Table 2:

3.3 KΩ Voltage	Experimental readings		
	Current, I	Voltage, I R	Power, I^2R
2	0.62mA	2.01V	1.25mW
4	1.24mA	4.02V	4.99mW
6	1.86mA	6.03V	11.22mW
8	2.48mA	8.04V	19.95mW
10	3.09mA	10.02V	30.96mW

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Questions and Answers:

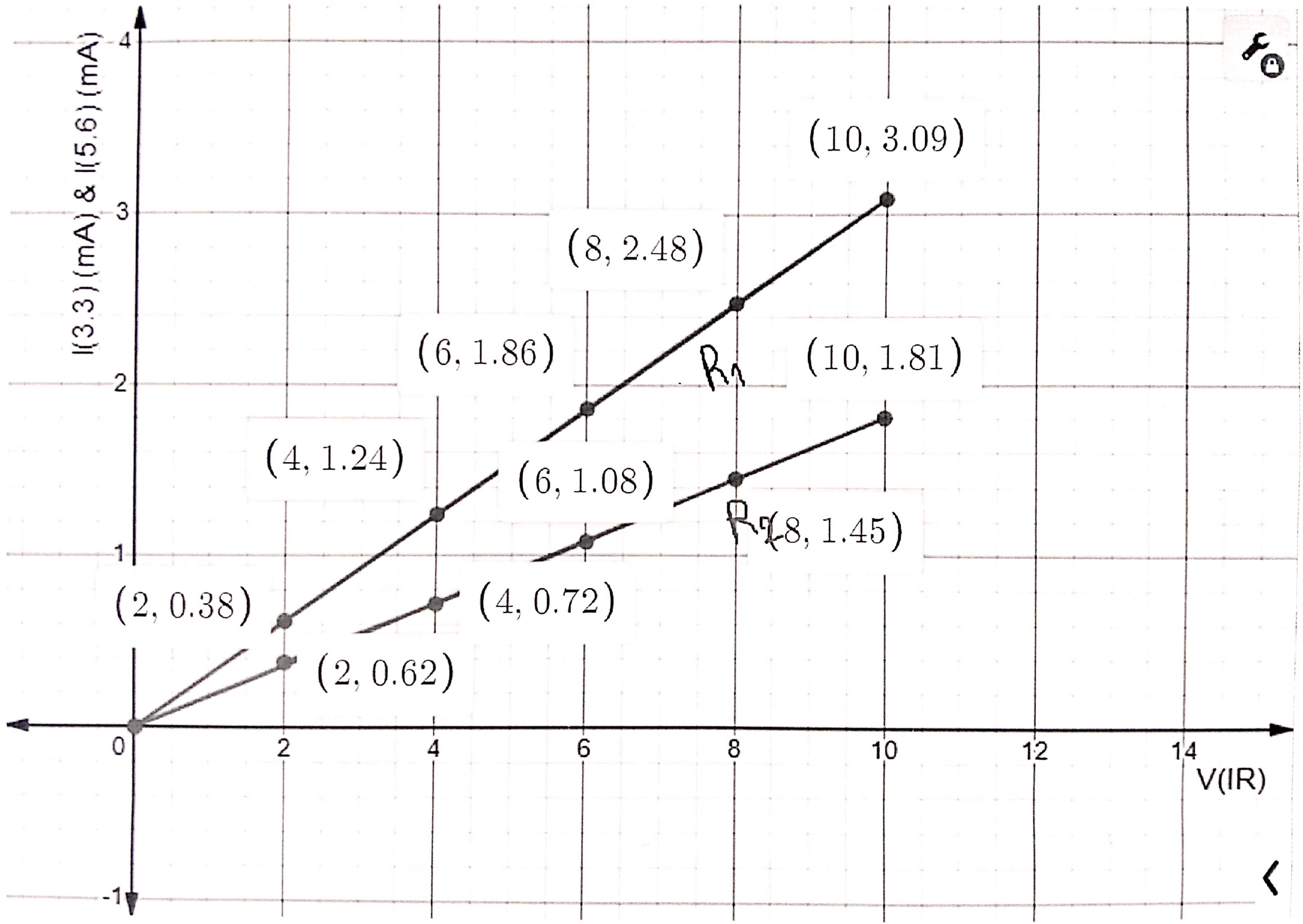
(1) State Ohm's law.

Answer: Ohm's law: Current through a conductor between two points is directly proportional to the voltage across the two points. Mathematically, Ohm's law can be expressed as, $I \propto V$, which with the constant of proportionality, the resistance R in the above equation, $I = \frac{V}{R}$ or, $V = IR$.

(2) Plot V vs I graph for each resistor value in same graph.

Answer: We had already measured the current flowing through the resistor by the Digital Multimeter in Laboratory and filled Table-2&3 with those values. Now we get the values from Table-2 and Table-3 and plotting the values on the graph.

Voltage, V	$I_{3.3}$ (mA)	$I_{5.6}$ (mA)
2	0.62	0.38
4	1.24	0.72
6	1.86	1.08
8	2.48	1.45
10	3.09	1.81


I(3.3) (mA) & I(5.6) (mA)
V(IR)
(10, 3.09)
(8, 2.48)
(6, 1.86)
(4, 1.24)
(2, 0.38)
(10, 1.81)
(8, 1.45)
(6, 1.08)
(4, 0.72)
(2, 0.62)
R1
R2
0
2
4
6
8
10
12
14
1
2
3
4
-1

(3) Does your experimental circuit follow Ohms law? Explain how did you figure it out.

Answer: Given, Voltage, $V = (2V, 4V, 6V, 8V, 10V)$

Resistance, $R = (3.3K\Omega, 5.6K\Omega)$

We Know, $V = IR$ or, $I = \frac{V}{R}$

Voltage (V)	$I_{3.3} = \frac{V}{R_1}$ (mA)	$I_{5.6} = \frac{V}{R_2}$ (mA)
2	0.61	0.36
4	1.21	0.71
6	1.81	1.07
8	2.42	1.42
10	3.03	1.78

Yes, our experimental circuit follow Ohm's law. Ohm's law states that the electrical current flowing through any conductor is directly proportional to the patential difference voltage between its ends, assuming the physical conditions of the conditions of the conductor do not charge. So, $V = IR$ or, $I = \frac{V}{R}$ Therefore, if we use the Ohm's law with the given resistor and voltage values, we can get our theoretical data. Here we can see the theoretical data and our experimental data (from (2)) are almost same. For that reason, we can figure out that our experimental circuit follow Ohm's law.

(4) Calculate the resistance of each circuit using the slope of your V vs I graph. Compare these R values from the graph to the measured R values using DMM. Find the percent difference.

Answer: We get, Resistance, $R = \frac{V}{I}$

Experimental Data (Using DMM)					Theoretical Data (Using Ohms law)				
V(V)	I(mA)	I'(mA)	R(KΩ)	R'(KΩ)	V(V)	I(mA)	I'(mA)	R(KΩ)	R'(KΩ)
2.01	0.62	0.38	3.2	5.5	2	0.61	0.36	3.3	5.6
4.02	1.24	0.72	3.2	5.5	4	1.21	0.71	3.3	5.6
6.03	1.86	1.08	3.2	5.5	6	1.81	1.07	3.3	5.6
8.04	2.48	1.45	3.2	5.5	8	2.42	1.42	3.3	5.6
10.02	3.09	1.81	3.2	5.5	10	3.03	1.78	3.3	5.6
			ΣR $=16$	$\Sigma R'$ $=27.5$				ΣR $=16.5$	$\Sigma R'$ $=28$

Experimental Data (Using DMM) mean:

$$M_R = \frac{\Sigma R}{N} = \frac{16}{5} = 3.2$$

$$M_{R'} = \frac{\Sigma R'}{N} = \frac{27.5}{5} = 5.5$$

Theoretical Data (Using Ohm's law) mean:

$$M'_R = \frac{\Sigma R}{N} = \frac{16.5}{5} = 3.3$$

$$M'_{R'} = \frac{\Sigma R'}{N} = \frac{28}{5} = 5.6$$

The percent difference for the first resistance

$$= \frac{|M_R - M'_R|}{M'_R} \times 100\%$$

$$= \frac{|3.2 - 3.3|}{3.3} \times 100\% = 3.03\%$$

The percent difference for the second resistance

$$= \frac{|M_{R'} - M'_{R'}|}{M'_{R'}} \times 100\% = \frac{|5.5 - 5.6|}{5.6} \times 100\% = 1.79\%$$

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Result analysis & Discussion:

From Table-1,

For the first resistor = orange color orange color (x Red color) ± Gold color

$= 33 \times 100\,\Omega \pm 5\%$

$= 3300\,\Omega \pm 5\%$

$= 3.3\,K\Omega \pm 5\%$

For the second resistor = green color blue color (x Red color) ± Gold color

$= 56 \times 100\,\Omega \pm 5\%$

$= 5600\,\Omega \pm 5\%$

$= 5.6\,K\Omega \pm 5\%$

For the first resistor, the percentage error

$$= \frac{|3.243 - 3.3|}{3.3} \times 100\%$$

$= 1.73\%$

For the second resistor, the percentage error

$$= \frac{|5.553 - 5.6|}{5.6} \times 100\% = 0.84\%$$

From Table-2,

when, Voltage $V = 2V$, Current $I = 0.62\ mA$,

Resistance $R = 3.3K\Omega$

Power, $I^2R = [(0.62)^2 \times 3.3]\ mW = 1.25\ mW$

when, Voltage $V = 4V$, Current $I = 1.24\ mA$,

Resistance $R = 3.3K\Omega$

Power, $I^2R = [(1.24)^2 \times 3.3]\ mW = 4.99\ mW$

when Voltage $V = 6V$, Current $I = 1.86\ mA$,

Resistance $R = 3.3K\Omega$

Power, $I^2R = [(1.86)^2 \times 3.3]\ mW = 11.22\ mW$

when Voltage $V = 8V$, Current $I = 2.48\ mA$,

Resistance $R = 3.3K\Omega$

Power, $I^2R = [(2.48)^2 \times 3.3]\ mW = 19.95\ mW$

when Voltage $V = 10V$, Current $I = 3.09\ mA$,

Resistance $R = 3.3K\Omega$

Power, $I^2R = [(3.09)^2 \times 3.3]\ mW = 30.96\ mW$

From Table-3,

When Voltage $V = 2V$, Current $I = 0.38mA$,

Resistance $R = 5.6K\Omega$

Power, $I^2R = [(0.38)^2 \times 5.6] mW = 0.802 mW$

When Voltage $V = 4V$, Current $I = 0.72mA$,

Resistance $R = 5.6K\Omega$

Power, $I^2R = [(0.72)^2 \times 5.6] mW = 2.879 mW$

When Voltage $V = 6V$, Current $I = 1.08 mA$,

Resistance $R = 5.6K\Omega$

Power, $I^2R = [(1.08)^2 \times 5.6] mW = 6.477 mW$

When Voltage $V = 8V$, Current $I = 1.45mA$,

Resistance $R = 5.6K\Omega$

Power, $I^2R = [(1.45)^2 \times 5.6] mW = 11.675 mW$

When Voltage $V = 10V$, Current $I = 1.81 mA$,

Resistance $R = 5.6K\Omega$

Power, $I^2R = [(1.81)^2 \times 5.6] mW = 18.192 mW$

From experiment 01, we learned about Ohm's Law and its verification by using the series circuit. In the experiment, we were provided two resistors and could determine the value of the resistors by color coding. The first resistor was 3.3KΩ and the second resistor was 5.6KΩ. We were also provided with a Digital Multimeter (DMM) to measure the current and voltage of the resistors. First, we took both 3.3KΩ and 5.6 KΩ resistors and inserted them on the bread board. Then we measured the resistor's resistance values using DMM and wrote the values in Table-01. We calculated the percentage error between the theoretical and experimental values of the resistors. Then we only took the 3.3KΩ resistor, made a series circuit using DC power supply as a voltage source and set that on 2V. Now we measured the voltage using DMM and opened the circuit before taking the source voltage reading to avoid the loading effect of internal resistance. Then we measured the current flowing through the resistor and calculated IR and I^2R using the experimental values of I and R in Table-02. Then we did the same process for 4V, 6V, 8V and 10V voltage sources and calculated IR and I^2R using the experimental values of I and R in Table-02. We also did the same process for the 5.6KΩ resistors, measured the voltage and current flowing through the 5.6KΩ resistor using DMM and filled Table-03.

The experimental and the theoretical data and graphs are almost the same. It does have flaws present in the real world, which could be coming from tolerance equipment in accuracy and loss of connection.

During the experimental, provided breadboard was not good and we faced some problems measuring current and voltage using DMM. Even then, we experimented properly.

Table of Contribution:

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Nasim Anzum Promise	2022655642
Muhammad Raiyan Alam	1831100642
Sumit Kumar Kar	2021646642

All the group members contributed equally.

Experiment Name:

Series Circuit

Objective:

(1) We have to learn how to connect a series circuit on a breadboard.

(2) We have to validate the voltage divider rules.

(3) We have to verify Kirchhoff's voltage law.

List of Equipment:

(1) Bread board

(2) DC power source

(3) Resistors (3.3KΩ, 4.7KΩ, 5.6 KΩ)

(4) Digital Multimeter (DMM)

(5) Connecting Wire

Theory:

Voltage divider rule is the rule that a series circuit has more than one resistors, the voltage across of each resistor is the ratio of resistor value multiplied with voltage source to total resistance value. In other words, it is a fundamental rule of circuit in the field of electronics which can produce a portion of its input voltage as an output. It is formed using two resistors and a voltage source. The resistors are connected in series here and the voltage is given across these two resistors.

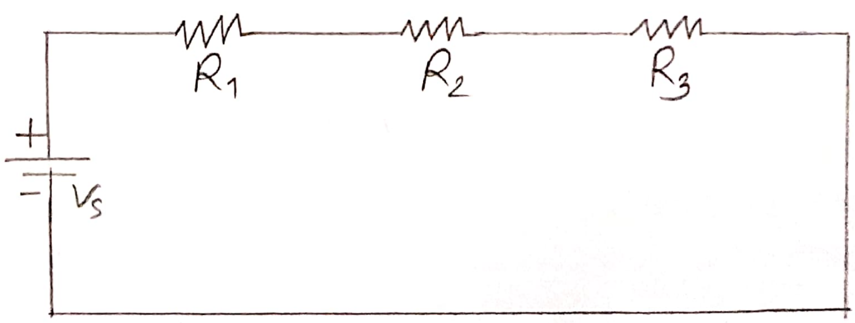

Fig: Voltage divider rule

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Let consider the above circuit there are three resistances. Using valtage divider rule,

$$V_1 = \frac{R_1}{R_1+R_2+R_3} V_S$$

$$V_2 = \frac{R_2}{R_1+R_2+R_3} V_S$$

$$V_3 = \frac{R_3}{R_1+R_2+R_3} V_S$$

Or,

$$V_x = E \cdot \frac{R_x}{R_T}$$

Where,

V_x = valtage across one or more elements

E = Total supply valtage

R_x = The resistance between the output points

R_T = The total resistance of all elements of the divider.

Kirchhoff's Valtage Law (KVL) states that the algebraic sum of all valtages in a loop must equal zero. Mathematically, it can be expressed as, $\sum_{m=1}^{M} V_m = 0$, where M is the number of valtages in the loop and V_m is the m number of valtage.

Or,

$$\Sigma E + \Sigma V = 0$$

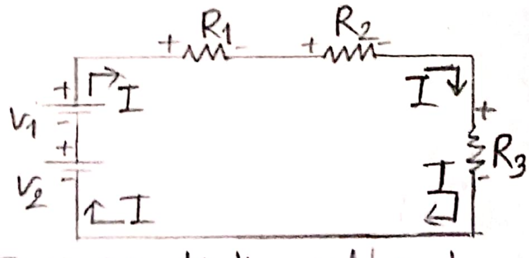

Fig: Kirchhoff's Valtage Law

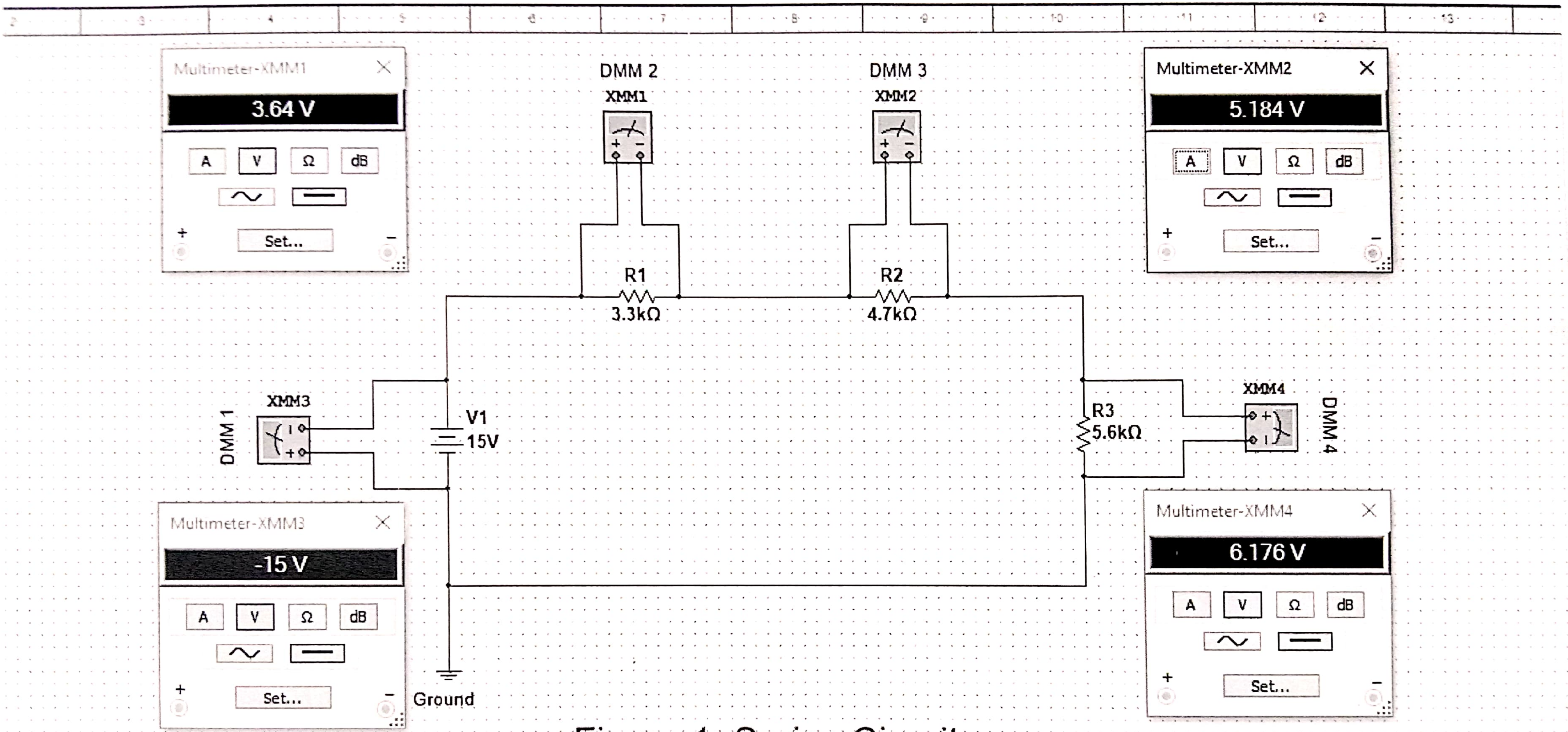

Figure 1: Series Circuit

Mosroor Mofiz Arman 1921079642

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Sumit Kumar Kar 2021646642

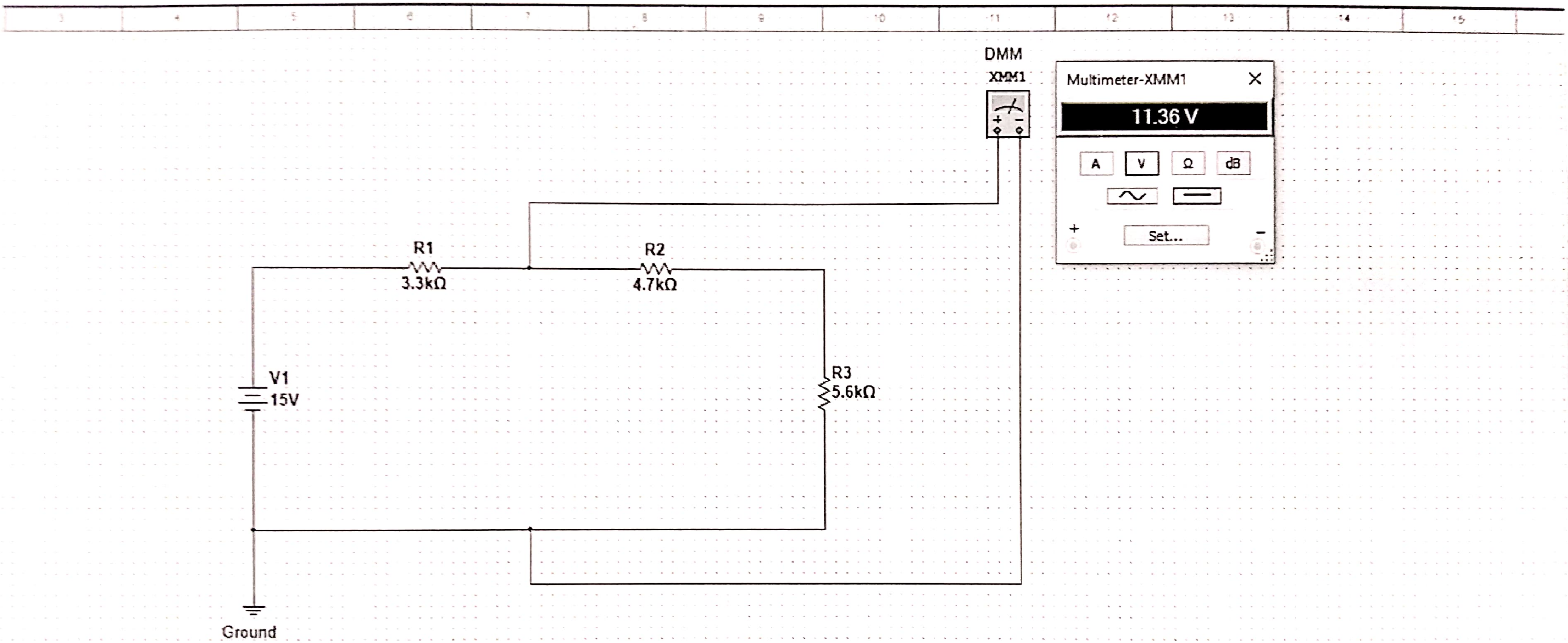

Figure 2: Series Circuit

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Data Collection for Exp2:

Lab 1: Exp2
Group No. 4
Instructor's Signature [illegible]

Please do all the calculations in 3 significant figures or 2 decimal places where applicable

Table 1:

Resistance using colour coding					Resistance using DMM	% Error
Band 1	Band 2	Band 3	Band 4	Resistance ± tol		
Orange (3)	Orange (3)	Red (100Ω)	Gold (±5%)	3.3KΩ ± 5%	3.195KΩ	3.182%
Yellow (4)	Violet (7)	Red (100Ω)	Gold (±5%)	4.7KΩ±5%	4.65KΩ	1.064%
Green (5)	Blue (6)	Red (100Ω)	Gold (±5%)	5.6KΩ±5%	5.54KΩ	1.071%

Table 2:

Experimental readings				Theoretical values			
V_S	V_{R1}	V_{R2}	V_{R3}	V_S	V_{R1}	V_{R2}	V_{R3}
15.05V	3.591V	5.21V	6.21V	15V	3.64V	5.18V	6.18V

% Error			
V_S	V_{R1}	V_{R2}	V_{R3}
0.33%	1.35%	0.58%	0.49%

Table 3:

Potential rise V_S	15.05V	Are the voltage rises and drops equal?
Potential drops (V_{R1} + V_{R1} + V_{R3})	(3.591V+5.21V+6.21V) =15.01V	Yes

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Table 4:

Experimental readings		Theoretical values	
V_{ab}	R_{eq}	V_{ab}	R_{eq}
11.46V	13.41KΩ	11.36V	13.6KΩ
% Error			
V_{ab}		R_{eq}	
0.88%		1.397%	

Report

Experiment 1:

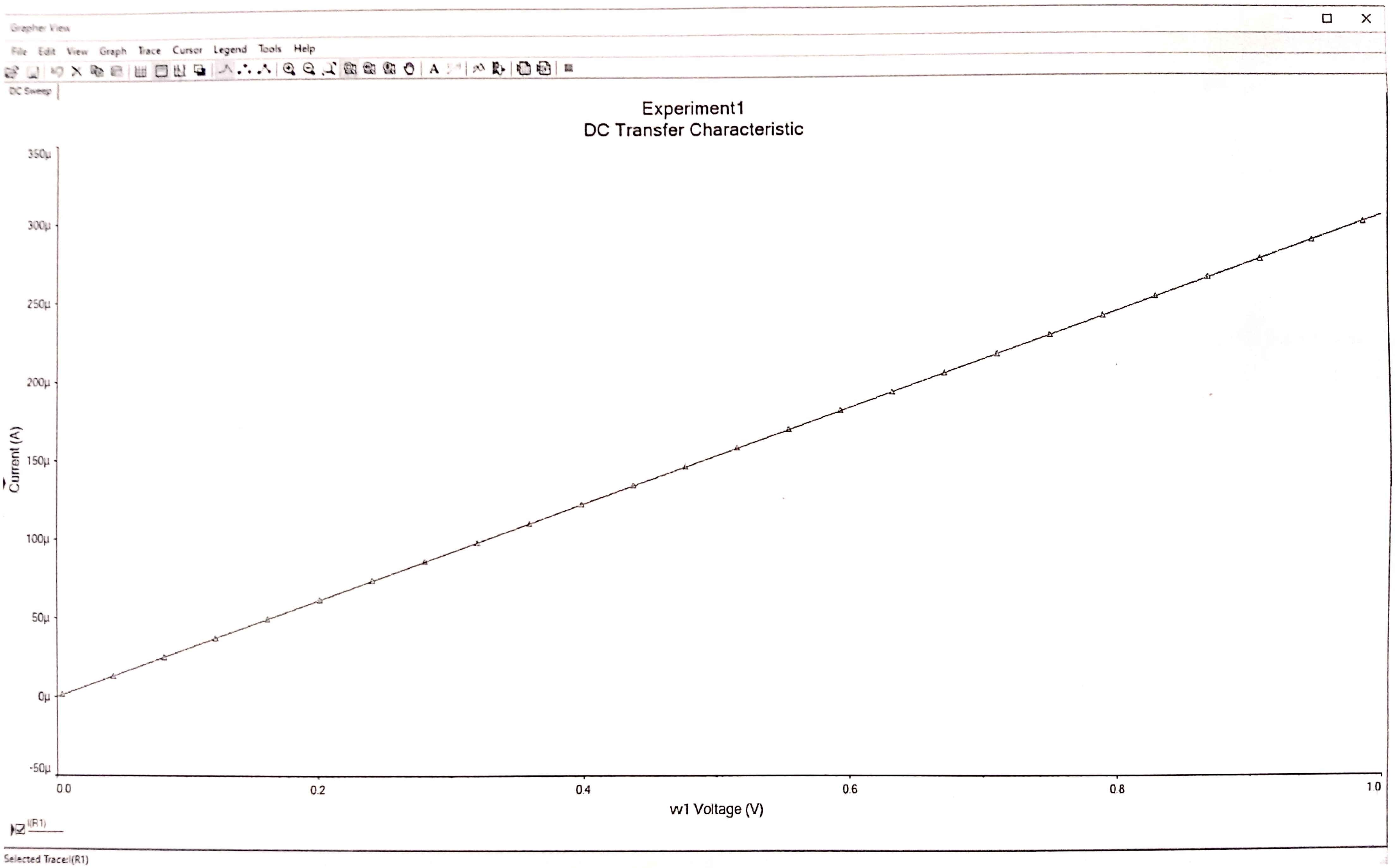
1. State Ohm's law.
2. Plot V vs I graph for each resistor value in same graph.
3. Does your experimental circuit follow ohm's law? Explain how did you figure it out.
4. Calculate the resistance of each circuit using the slope of your V vs I graphs. Compare these Rgraph values to the measured R values using DMM. Find the percent difference.

Experiment 2:

1. State the voltage division rule.
2. State the Kirchhoff's voltage law (KVL).
3. Showing all steps, calculate the theoretical values in Table 2. Compare theoretical values to your experimental values and explain whether your circuit follows KVL or not.
4. Showing all the calculations, theoretically calculate Vab. Compare with the experimental value and verify the voltage division rule at the terminal a-b.
5. Showing all the steps, calculate Req. Compare with the experimental value.

Useful Formula:

Voltage Divider Rule: $V_X = E\ R_X / R_T$
% Error = (Theoretical value – Experimental Value) / Theoretical Value



Grapher View
File Edit View Graph Trace Cursor Legend Tools Help
DC Sweep
Experiment1
DC Transfer Characteristic
Current (A)
350µ
300µ
250µ
200µ
150µ
100µ
50µ
0µ
-50µ
0.0
0.2
0.4
0.6
0.8
1.0
w1 Voltage (V)
I(R1)
Selected Trace:I(R1)

Questions and Answers:

(1) State the voltage division rule.

Answer: The voltage division rule states that the total voltage applied across a series connection of multiple resistors is divided among the resistors in proportional to their resistance. The voltage division rule can be expressed as $V_n = E \frac{R_x}{R_T}$

(2) State the Kirchhoff's voltage law (KVL).

Answer: The Kirchhoff's voltage law (KVL) states the voltage around a closed path algebraically sum to zero. In other words, the sum of voltage rise equals the sum of voltage drop. The equation is: $\sum_{m=1}^{M} V_m = 0$

(3) Showing all steps, calculate the theoretical values in Table 2. Compare theoretical values to your experimental values and explain whether your

circuit follows KVL or not.

Answer : Experimental Data:

Total Resistance, $R_T = R_1 + R_2 + R_3 = (3.195 + 4.65 + 5.54)$ $K\Omega$

$= 13.385 K\Omega$

Power Source, $V_s = 15.05V$

$$V_{R_1} = \frac{15.05 \times 3.195}{13.385} V = 3.591V$$

$$V_{R_2} = \frac{15.05 \times 4.65}{13.385} V = 5.21V$$

$$V_{R_3} = \frac{15.05 \times 5.54}{13.385} V = 6.21V$$

Theoretical Data:

Total Resistance, $R_T' = R_1' + R_2' + R_3' = (3.3 + 4.7 + 5.6)$ $K\Omega$

$= 13.6 K\Omega$

Power Source, $V_s' = 15V$

$$V_{R_1'} = \frac{15 \times 3.3}{13.6} V = 3.64V$$

$$V_{R_2}' = \frac{15 \times 4.7}{13.6} V = 5.18V$$

$$V_{R_3'}' = \frac{15 \times 5.6}{13.6} V = 6.18V$$

Comparison:

$$V_1 = \frac{|V_{R_1} - V'_{R_1}|}{V'_{R_1}} \times 100\% = \frac{|3.591 - 3.64|}{3.64} \times 100\%$$

$$= 1.35\%$$

$$V_2 = \frac{|V_{R_2} - V'_{R_2}|}{V'_{R_2}} \times 100\% = \frac{|5.21 - 5.18|}{5.18} \times 100\%$$

$$= 0.58\%$$

$$V_3 = \frac{|V_{R_3} - V'_{R_3}|}{V'_{R_3}} \times 100\% = \frac{|6.21 - 6.18|}{6.18} \times 100\%$$

$$= 0.49\%$$

For Experimental Data,

Voltage Rise $= 15.05V \approx 15V$

Voltage Drop $= (V_{R_1} + V_{R_2} + V_{R_3}) = (3.591 + 5.21 + 6.21)V$

$= 15.01V \approx 15V$

For Theoretical Data,

Voltage Rise $= 15V$

Voltage Drop $= (V'_{R_1} + V'_{R_2} + V'_{R_3}) = (3.6 + 5.18 + 6.18)V$

$= 15V$

Therefore, voltage rise = voltage drop which follows KVL.

(4) Showing all calculations, theoretically calculate V_{ab}. Compare with the experimental value and verify the voltage division rule at the terminal a-b.

<u>Answer:</u> Experimental Data:

$V_{ab} = 11.46V$

Theoretical Data:

$V'_{ab} = V'_s - V'_a = (15 - 3.64)V = 11.36V$

$$\therefore \text{Comparison} = \frac{|V_{ab} - V'_{ab}|}{V'_{ab}} \times 100\%$$

$$= \frac{|11.46 - 11.36|}{11.36} \times 100\%$$

$$= 0.88\%$$

As the result is almost same, we can say that the voltage division rule at the terminal a-b is verified.

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(5) Showing all steps, calculate R_{eq}. Compare with the experimental value.

Answer: Experimental Data:

$R_{eq} = 13.41\ K\Omega$

Theoretical Data:

$R'_{eq} = R'_1 + R'_2 + R'_3 = (3.3 + 4.7 + 5.6)\ K\Omega$

$= 13.6\ K\Omega$

$\therefore \text{Comparison} = \dfrac{|R_{eq} - R'_{eq}|}{R'_{eq}} \times 100\%$

$= \dfrac{|13.41 - 13.6|}{13.6} \times 100\%$

$= 1.397\%$

2.22

Result analysis & Discussion:

From Table-1,

For the first resistor = orange color orange color (x red color) ± gold color

$= 33 \times 100\,\Omega \pm 5\%$

$= 3300\,\Omega \pm 5\%$

$= 3.3K\,\Omega \pm 5\%$

For the second resistor = yellow color violet color (x red color) ± gold color

$= 47 \times 100\,\Omega \pm 5\%$

$= 4700\,\Omega \pm 5\%$

$= 4.7K\,\Omega \pm 5\%$

For the third resistor = green color blue color (x red color) ± gold color

$= 56 \times 100\,\Omega \pm 5\%$

$= 5600\,\Omega \pm 5\%$

$= 5.6K\,\Omega \pm 5\%$

2.22

For the first resistor, the percentage error

$$= \frac{13.195 - 3.31}{3.3} \times 100\% = 3.182\%$$

For the second resistor, the percentage error

$$= \frac{14.65 - 4.71}{4.7} \times 100\% = 1.064\%$$

For the third resistor, the percentage error

$$= \frac{15.54 - 5.61}{5.6} \times 100\% = 1.071\%$$

From Table-2,

Power Source, $V_s = 15V$

Total Resistance, $R_T = (3.3 + 4.7 + 5.6) K\Omega$

$= 13.6 K\Omega$

$$\therefore V_{R_1} = \frac{15 \times 3.3}{13.6} V = 3.64V$$

$$\therefore V_{R_2} = \frac{15 \times 4.7}{13.6} V = 5.18V$$

$$\therefore V_{R_3} = \frac{15 \times 5.6}{13.6} V = 6.18V$$

Error :

$$V_S = \frac{|15.05 - 15|}{15} \times 100\% = 0.33\%$$

$$V_{R_1} = \frac{|3.591 - 3.64|}{3.64} \times 100\% = 1.35\%$$

$$V_{R_2} = \frac{|5.21 - 5.18|}{5.18} \times 100\% = 0.58\%$$

$$V_{R_3} = \frac{|6.21 - 6.18|}{6.18} \times 100\% = 0.49\%$$

Potential rise, $V_S = 15.05V$

Potential drops $= (V_{R_1} + V_{R_2} + V_{R_3})$

$= (3.591 + 5.21 + 6.21)V$

$= 15.01V$

From Table-4,

$V_{ab} = (15 - 3.64)V = 11.36V$

$R_{eq} = (3.3 + 4.7 + 5.6)K\Omega = 13.6K\Omega$

Error :

$$V_{ab} = \frac{|11.46 - 11.36|}{11.36} \times 100\% = 0.88\%$$

$$R_{eq} = \frac{|13.41 - 13.6|}{13.6} \times 100\% = 1.397\%$$

From experiment 02, we learned about Kirchhoff's Law and the voltage divider rule by using the series circuit.

In the experiment, we were provided three resistors and could determine the value of the resistors by color coding. The first resistor was 3.3KΩ, the second resistor was 4.7KΩ and the third resistor was 5.6KΩ. We were also provided with a Digital Multimeter (DMM) to measure the current and voltage of the resistors. First, we took all resistors and inserted them on the breadboard. Then we measured the resistor's resistance values using DMM and wrote the values in Table-01. We calculated the percentage error between the theoretical and experimental values of the resistors. Then we made a series circuit with those resistors using the DC power supply as a voltage source and set that on 15V. We measured the potential difference across the voltage source and resistors using DMM and wrote the values in Table-02. Then we filled Table-03 by calculating the values from Table-02. Afterward, we find out both experimental and theoretical values of V_{ab} and total load resistance (R_{eq}) values using DMM and filled Table-04. Before measureing R_{eq}, we ensured that the voltage source DC power supply was disconnected.

The experimental and theoretical data and graphs are almost same. It does have flaws present in the real world, which colld be coming from tolerance equipment in accuracy and loss of connection.

During the experiment, provided breadboard was not good and we faced some problems measuring current and voltage using DMM. Even then, we experimented properly.

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