Teacher's Signature: _____
Date: _____

United International University

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Section: E Group: 2 Trimester: Spring Date: 7/5/2022

Experiment No. 07

Name of the Experiment: Verification of Ohm's Law.

OBJECTIVE:

To verify the following two equivalent forms of Ohm's Law:

a. Express I as a function of V and R.
b. Express V as a function of I and R.

THEORY:

Ohm's law describes mathematically how voltage 'V', current 'I' and resistance 'R' in a circuit are related. According to this law:

"The current in a circuit is directly proportional to the applied voltage and inversely proportional to the circuit resistance".

Formula for voltage:
For a constant value of R, V is directly proportional to I
i.e. $V = IR$

Formula for current:
For a constant value of V, I is inversely proportional to R
i.e. $I = V/R$

EQUIPMENTS:

- Variable DC power supply -1piece.
- Digital multimeter (DMM)/ Analog multimeter-1piece.
- Resistances: 1KΩ, 2.2KΩ, 33KΩ, 4.7KΩ, 5.6KΩ, 10KΩ-1piece each.
- Trainer Board.
- Connecting Wires.

CIRCUIT DIAGRAM:

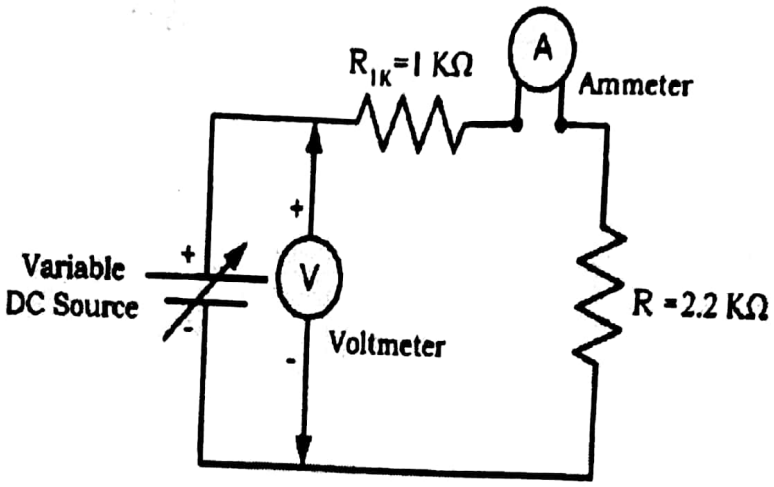

Figure 2.1: Verification of Ohm's Law

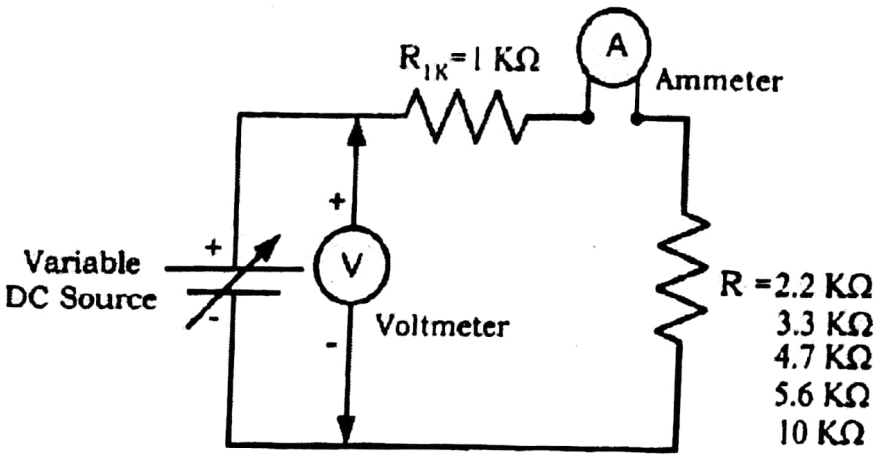

Figure 2.2 : Verification of Ohm's Law

PROCEDURES:

Current versus voltage:

a. Construct the circuit of Figure 2.1. Do not switch on the power supply.
b. Tum on the power supply and adjust it to 5V by using Voltmeter. Measure the current I by ammeter and record it in the Table 2.2.
c. Increase the values of voltage as shown in the Table 2.2. Measure the current I in tum and record the values in Table 2.2.
d. Calculate the values of current I by using $I=V/R_T$. Use measured values of resistances.

Current versus resistance:

a. Construct the circuit of Figure 2.2. Do not switch on the power supply.
b. Tum on the power supply and adjust it to 20V by using Voltmeter. Measure the current I by ammeter for R=2.2 KΩ (Use measured values) and record it in the Table 2.3.
c. Tum off the power supply and remove the resistance 2.2 KΩ. Replace it by resistor 3.3 KΩ.
d. Now turn on the power supply. Measure and record the current I in tum, at each of the resistance settings shown in the Figure 2.2.
e. Calculate the values of resistance R_T by using $R_T=V/I$. Use measured values of voltage and current.

DATA SHEET:

Table 2.1: Measuring Resistances by using Ohmmeter

Nominal values of R (KΩ)	Measured values of R (KΩ) by using Ohmmeter
1	0.97
2.2	2.15
3.3	3.19
4.7	4.58
5.6	4.52
10	9.98

Table 22: Current versus voltage

Supply Voltage (V)	Measured I by using Ammeter (A)	$R_T = R_{1K\Omega} + R_{2.2K\Omega}$ [Use measured values of R]	Calculate I (amp) $I=V/R_T$	Measured Resistance $R_T=V/I$
5	1.5	3.12	1.603	3.33
10	3	3.12	3.205	3.33
15	4.5	3.12	4.807	3.33
20	6	3.12	6.410	3.33
25	7.5	3.12	8.012	3.33

Table 23: Current versus resistance

Supply Voltage (V)	Measured I by using Ammeter (mA)	R_T (KΩ) Use measured values of R	Calculate $R_T=V/I$ (KΩ)
20	6	$R_T=R_{1K}+R_{2.2K}$ $R_T=$ 3.12	3.33
20	5	$R_T=R_{1K}+R_{3.3K}$ $R_T=$ 4.16	4
20	3.5	$R_T=R_{1K}+R_{4.7K}$ $R_T=$ 5.55	5.71
20	3	$R_T=R_{1K}+R_{5.6K}$ $R_T=$ 5.49	6.66
20	1.5	$R_T=R_{1K}+R_{10K}$ $R_T=$ 10.95	13.33

Signature of the Teacher

Discussions:

Q: What can you say about the relationship between the voltage and current, provided that the resistance is fixed?

We know that,

$V = IR$ | V = Voltage, I = current, R = Resistance.

if resistance is fixed.

$V \propto I$

that means, if voltage is increases then current will also increase or if voltage in decrease current will also decrease

Q: Plot a graph of I versus V keeping the value of resistance constant. Use measured values of I and V. Comment on the graph briefly.

$$\text{Slope} = \tan\theta = \frac{dy}{dx} = \frac{I}{V} = \frac{7.4}{25-10} = 0.293 \text{ mA/V}$$

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

$$\text{Slope}^{-1} = \frac{1}{\text{Slope}} = \frac{1}{\frac{I}{V}} = \frac{V}{I}.$$

$\therefore R = (0.293)^{-1} = 3.412 \text{ k}\Omega$

The graph indicats that, if V increased then current (I) will be increase also.

Q: Plot a graph of I versus R_T keeping the value of supply voltage constant. Use measured values of I and R_T.

Comment on the graph briefly.

$V = IR$

$V_1 = I_1 R_1 = 6 \times 3 = 18 \text{ V}$

$V_2 = I_2 R_2 = 3.9 \times 5 = 19.5 \text{ V}$

$V_3 = I_3 R_3 = 2 \times 9 = 18$

$$V = \frac{V_1 + V_2 + V_3}{3} = \frac{18 + 19.5 + 18}{3} = 18.5 \text{ V}$$

$V_s = 20 \text{ V}$

$V_m = V = 18.5 \text{ V}$

$\therefore V_s \simeq V$

Ohm's law is verified

From the graph we see that, the graph is decrease.

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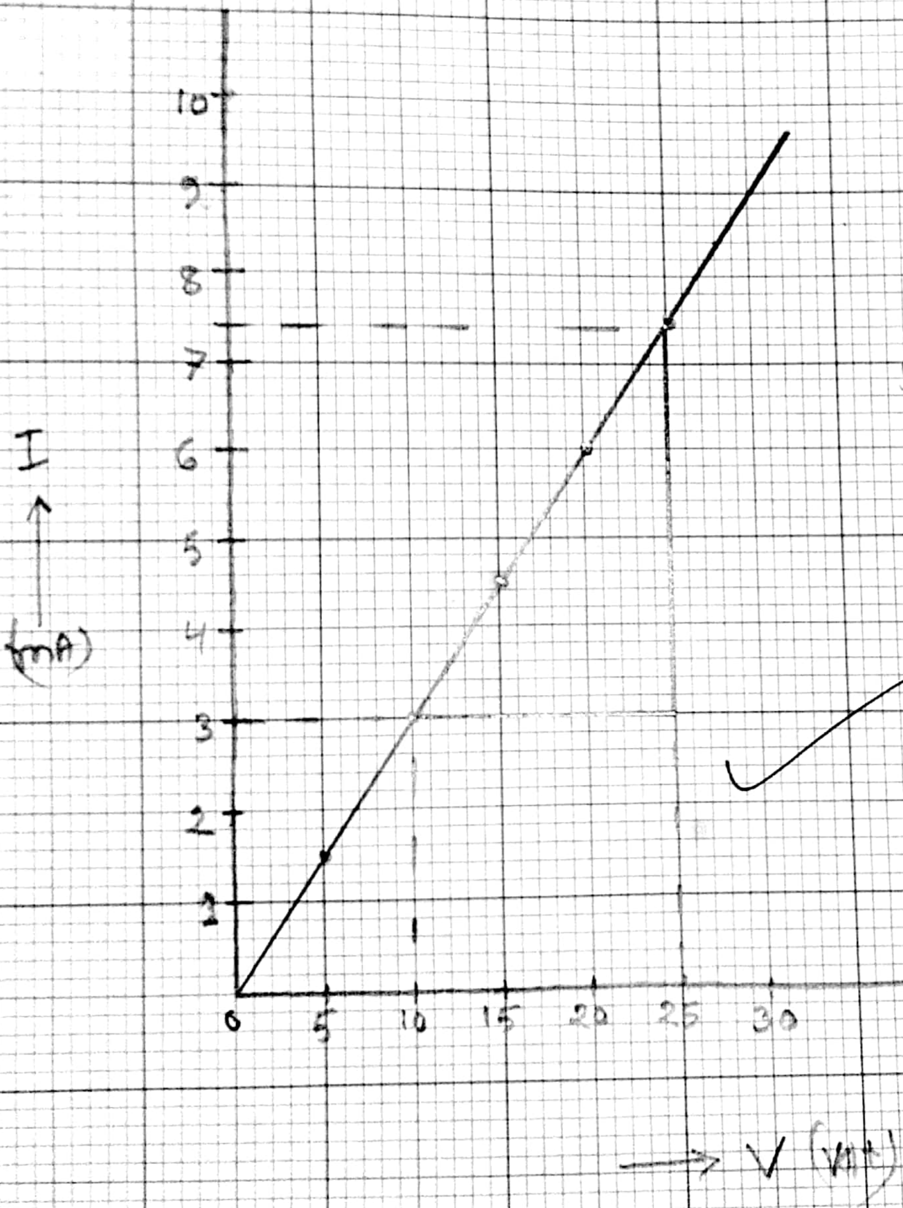
I vs V graph



Slope $= \tan\theta = \frac{dy}{dx} = \frac{I}{V}$ mA/V

$= \frac{7.4-3}{25-10} = 0.293$

$V = IR$, $R = \frac{V}{I} = \frac{1}{I/V}$

Slope$^{-1} = \frac{1}{\text{slope}}$

$\therefore R = (0.293)^{-1} = 3.412\ k\Omega$

25/2/22

8 Inch x 10 Inch

MICRO

Name: Nazmul Hoda

I vs R_T graph

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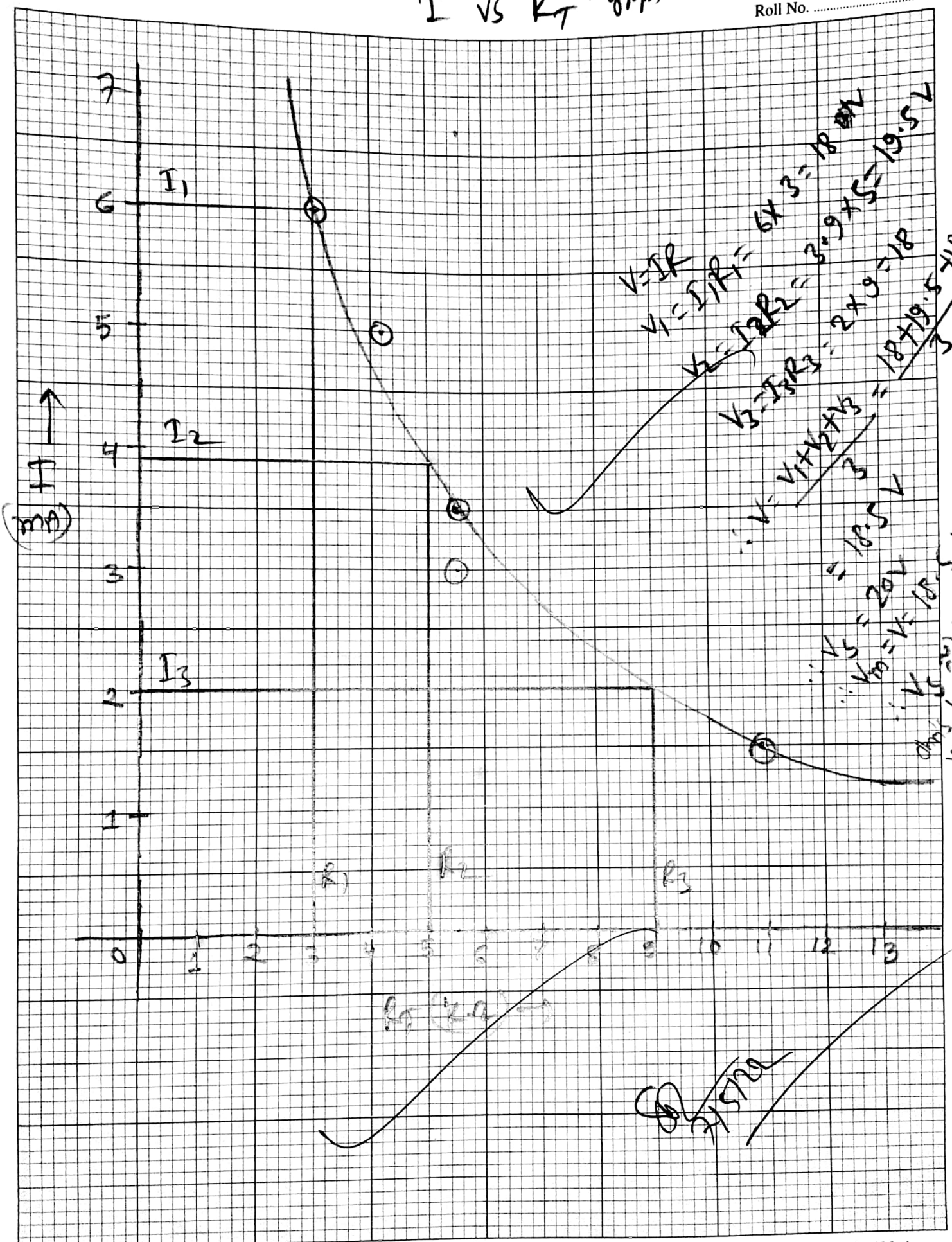

$V = IR$

$V_1 = I_1 R_1 = 6 \times 3 = 18\ V$

$V_2 = I_2 R_2 = 3 \cdot 9 \times 5 = 19.5\ V$

$V_3 = I_3 R_3 = 2 \times 9 = 18$

$\therefore V = \frac{V_1 + V_2 + V_3}{3} = \frac{18 + 19.5 + 18}{3}$

$= 18.5\ V$

$\therefore V_3 = V_2 = 20\ V$

$\therefore V_3 = V = 18.5\ V$

MICRO

N.P. 8 Inch x 10 Inch