North South University
Department of Electrical & Computer Engineering

LAB REPORT

Course Name: **EEE141 Lab**

Experiment Number: **03**

Experiment Name: **Loading Effect of Voltage Divider Circuit**

Faculty: **SSH1**

Experiment Date: **03-07-22**

Report Submission Date: **17-07-22**

Section: **08**

Group: **04**

Name and ID:	
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Remarks:	

Experiment Name: Loading Effect of Voltage Divider Circuit.

Objective: (i) Analyzing how the voltag divider circuit behaves when there is no load resistance connected.

(ii) Evaluating the performance of voltage divider circuit due to loading.

List of Equipment:

(i) Trainer Board

(ii) DMM

(iii) 2×560Ω resistors

(iv) 1× (0-10Ω) variable resistor

Theory: Voltage divider circuit gives a basic method for switching a DC voltage over completely to another lower DC voltage.

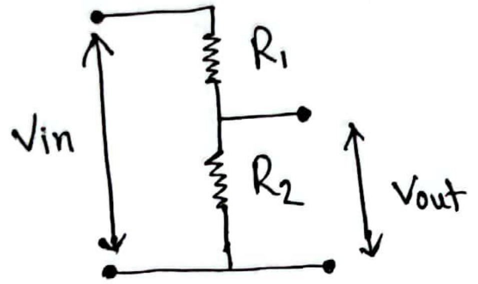


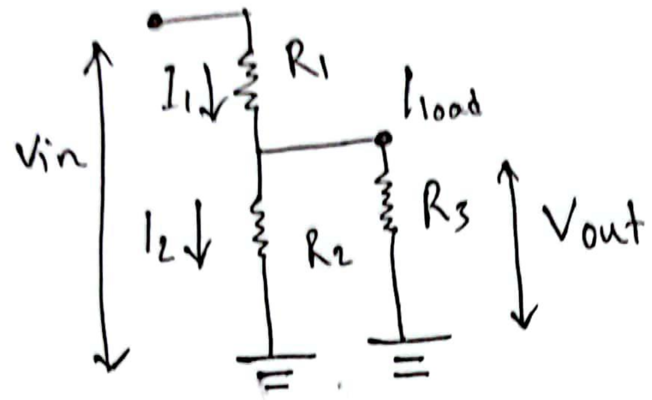
Figure 1: A voltage divider

When a load resistance R_L is connected across the output terminals of the voltage divider, the voltage divider is said to be loaded. In Figure 1, there is no output load (R_L) connected in parallel to R_2 hence we call it a No-Load circuit.

According to voltage divider rule

$$V_{out} = V_{in} \frac{R_2}{R_1 + R_2}$$

Now we connect an output load, R_3 in parallel to R_2



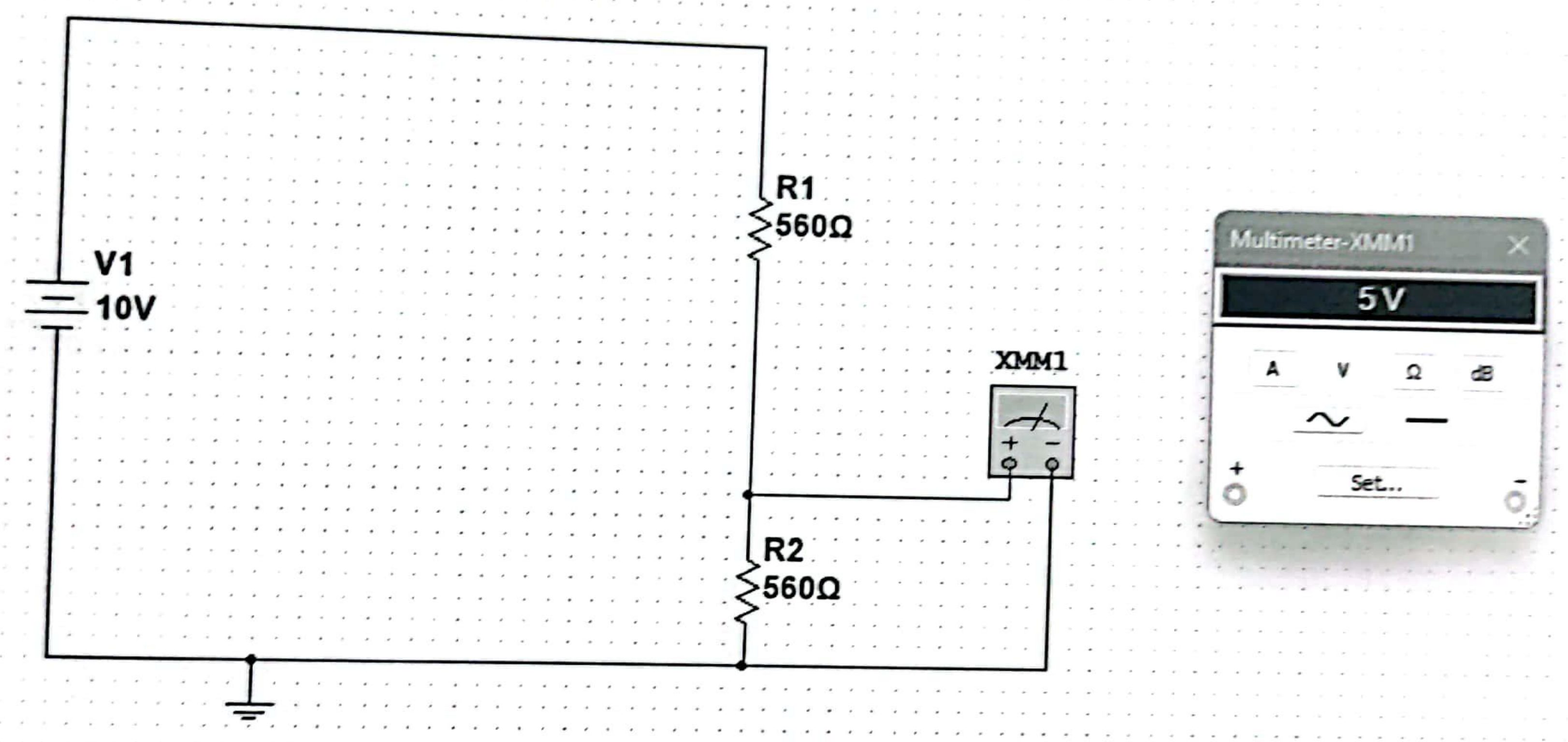
So, $V_{out} = V_{in} \dfrac{(R_2 // R_3)}{R_1 + (R_2 // R_3)}$

The loading of voltage divider has following effects

(i) the output voltage decreases depending upon the value of load resistor R_L.

(ii) After connected the load resistor, the voltage divider circuit turned into a series-parallel circuit. Therefore the total resistance of the circuit is reduced.

(iii) The circuit current increases because the total resistance of the circuit is decreased.



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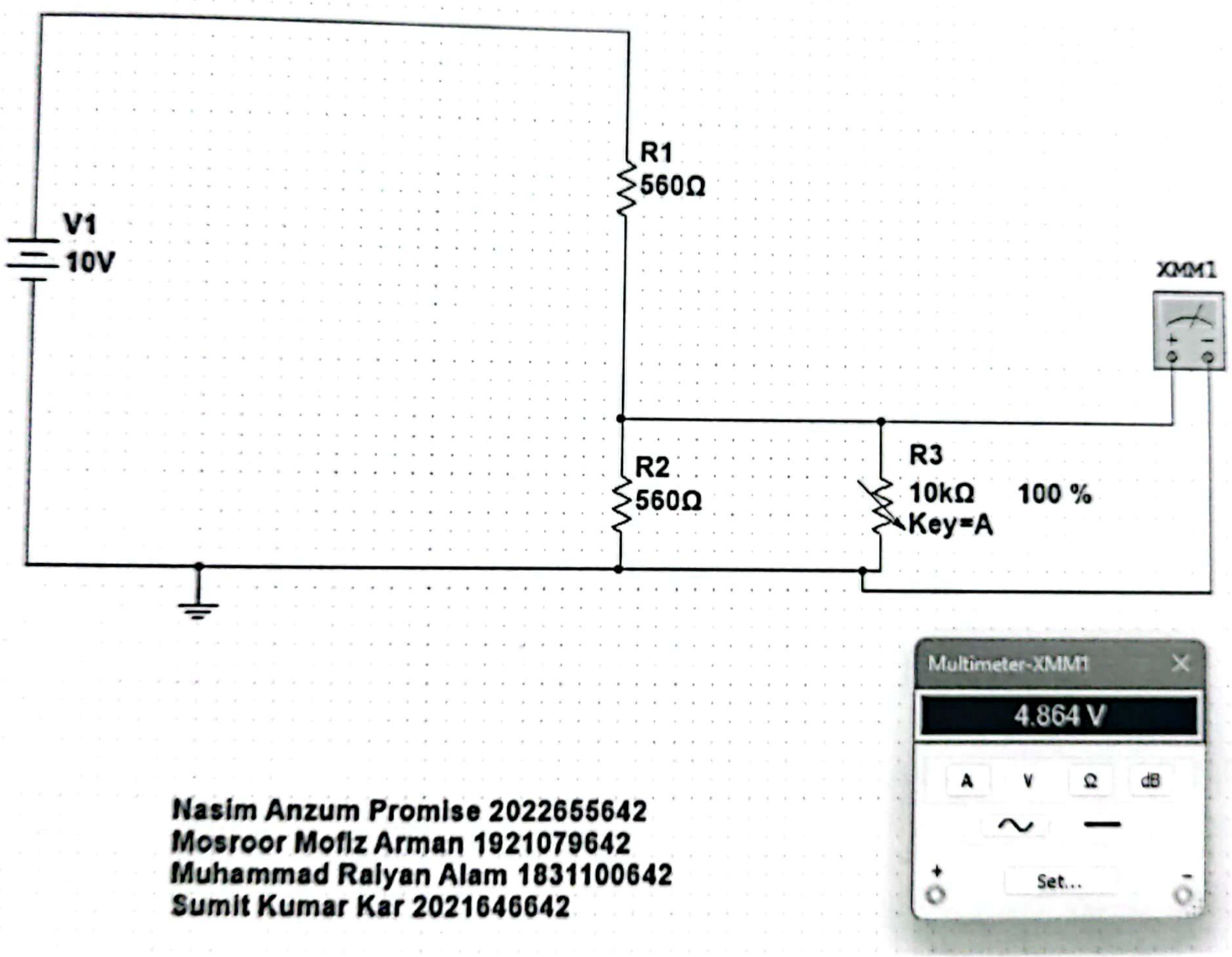
V1
10V
R1
560Ω
R2
560Ω
R3
10kΩ 100 %
Key=A
XMM1
Multimeter-XMM1
4.864 V
A V Ω dB
Set...
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Data Collection for Lab 3:

Group No. 04

Instructor's Signature [signature]

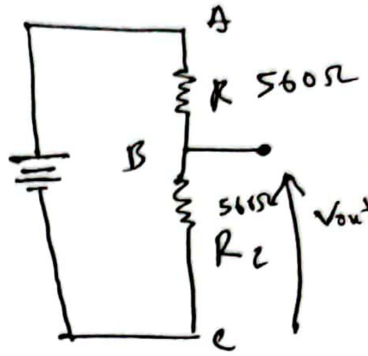
Table 1:

RL	Vout (Measured)	Vout (Calculated)	%Error
No resistor	5.00V	5.00V	0%
1k	3.94V	3.90V	1.02%
4k	4.63V	4.67V	0.86%
7k	4.73V	4.80V	1.47%
10k	4.80V	4.86V	1.25%

Report Question:

1. Explain the loading effect of your circuit (i.e. explain how does your Vout vary with increasing Load resistor)
2. Showing all steps in details, theoretically calculate the value of Vout for each load resistor.
3. Comparing the theoretical data to the experimental data, comment how far the loading effect of your circuit supports.

Data and Table:



Vout (No resistor) = 5.00V

% Error = 0%

Vout (1K)

$$R_{BC\,eq} = \frac{560 \times 1000}{560 + 1000} = 358.97\,\Omega$$

$$R_{eq} = R_{AB} + R_{BC\,eq} = 560\,\Omega + 358.95\,\Omega$$

$$= 918.97\,\Omega$$

$$V_{out} = V \times \frac{R_{BC\,eq}}{R_{eq}} = 10 \times \frac{358.95}{918.97} = 3.90\,V$$

$$\%\ Error = \frac{3.94 - 3.90}{3.90} \times 100\%$$

$$= 1.02\%$$

Vout (4K)

$$R_{BC\,eq} = \frac{560 \times 4000}{560 + 4000} = 491.22\,\Omega$$

$$R_{eq} = R_{AB} + R_{BC\,eq} = 560 + 491.22$$

$$= 1051.22\,\Omega$$

$$V_{out} = V \frac{R_{BC\,eq}}{R_{eq}} = 10 \times \frac{491.22}{1051.22} = 4.67\,V$$

$$\% \text{ Error} = \frac{4.67 - 4.63}{4.63} \times 100\%$$

$$= 0.86\%$$

V_{out} (7K)

$$R_{BC\,eq} = \frac{560 \times 7000}{560 + 7000} = 518.51\,\Omega$$

$$R_{eq} = 560 + 518.51\,\Omega = 1078.5\,\Omega$$

$$V_{out} = 10 \times \frac{518.51}{1078.5} = 4.80\,V$$

$$\% \text{ Error} = \frac{4.80 - 4.73}{4.73} \times 100\%$$

$$= 1.47\%$$

V_{out} (10K)

$$R_{BC\,eq} = \frac{560 \times 10000}{560 + 10000} = 530.30\,\Omega$$

$$R_{eq} = 560 + 530.30 = 1090.30\,\Omega$$

$$V_{out} = 10 \times \frac{530.30}{1090.30} = 4.86\,V$$

$$\% \text{ Error} = \frac{4.86 - 4.80}{4.80} \times 100\%$$

$$= 1.25\%$$

Questions and Answer:

1. In our circuit without any load the Vout is 5·00V. Now increasing the load ~~Req~~ resistor we can observe that the Vout almost reaches no load Vout. The more we increase the load resistor the closer it reaches no load state. But Vout on load will never be equal to Vout on no load.

2. Vout (1K)

$$R_{BCeq} = \frac{560 \times 1000}{560 + 1000} = 358 \cdot 97\Omega$$

$$R_{eq} = R_{AB} + R_{BCeq} = 560\Omega + 358 \cdot 97\Omega$$
$$= 918 \cdot 97\Omega$$

$$V_{out} = V \times \frac{R_{BCeq}}{R_{eq}} = 10 \times \frac{358 \cdot 95}{918 \cdot 97} = 3 \cdot 90V$$

Vout (4K)

$$R_{BCeq} = \frac{560 \times 4000}{560 + 4000} = 491 \cdot 22\Omega$$

$$R_{eq} = R_{AB} + R_{BCeq} = 560 + 491 \cdot 22 = 1051 \cdot 22\Omega$$

$$V_{out} = V \times \frac{R_{BCeq}}{R_{eq}} = 10 \times \frac{491 \cdot 22}{1051 \cdot 22} = 4 \cdot 67V$$

Vout (7K)

$$R_{BCeq} = \frac{560 \times 7000}{560 + 7000} = 518 \cdot 51\,\Omega$$

$$R_{eq} = 560 + 518 \cdot 51 = 1078 \cdot 5\,\Omega$$

$$V_{out} = 10 \times \frac{518 \cdot 51}{1078 \cdot 5} = 4 \cdot 80\,V$$

Vout (10K)

$$R_{BCeq} = \frac{560 \times 10000}{560 + 10000} = 530 \cdot 30\,\Omega$$

$$R_{eq} = 560 + 530 \cdot 30\,\Omega = 1090 \cdot 30\,\Omega$$

$$V_{out} = 10 \times \frac{530 \cdot 30}{1090 \cdot 30} = 4 \cdot 86\,V$$

3. The theoretical data and experimental data are almost same. The more we increase the load ressistor the closer it reaches no load state. But Vout on load will never be equal to Vout on no load.

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Result analysis and Discussion:

In this lab we learned about Loading effect of voltage divider circuit.

In the equipment, we were provided two 560Ω resistors and one (0-10KΩ) variable resistor. We were also provided with a Digital Multimeter (DMM) to measure the circuit voltage of the ~~reg circuit~~ registor:

First we took the registors, and completed the circuit in breadboard. First we measured Vout without variable registor. After that we connected our variable registor and measured value at 1K, 4K, 7K and 10K ohm and wrote the values in the table. Then we calculated Vout with theorytical knowledge and also calculated % error and wrote in the table. The measured values and ~~theoryti~~ theoritical values are almost same.

Table of Contributions:

Nasim Anzum Promise 2022655642

- Vout (Measured), Vout calculation, % Error and lab reports

Mosroon Mofiz Arman 1921079642

- circuit build and value check

Sumit Kumar Kar 2021646642

- Value check and circuit buid

Muhammad Raiyan Alam 1831100642

- circuit build and value check