North South University
Department of Electrical & Computer Engineering

LAB REPORT

Course Name: **EEE141 Lab**

Lab No: **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**

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Remarks:	

Experiment Name: Loading Effect of Voltage Divider Circuit.

Objective: ① Analyzing how the voltag divider circuit behaves when there is no load resistance connected.

② Evaluating the performance of voltage divider circuit due to loading.

List of Equipment:

(I) Thainer Board

(II) DMM

(III) $2 \times 560 \Omega$ resistors

(IV) $1 \times (0 - 10 \Omega)$ variable resistor

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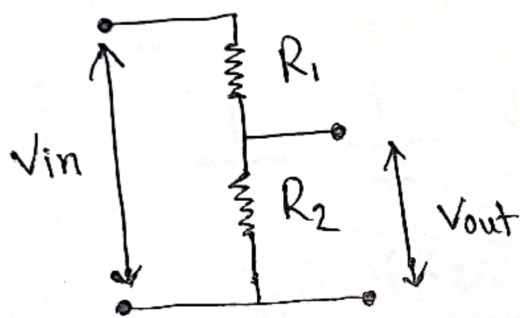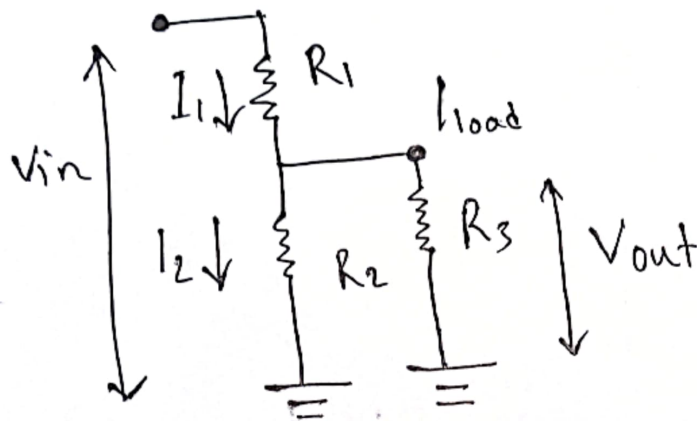

Figure 1: A voltage divider

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, the output is no load (R_L) connected in parallel to R_L hence we call it a No-load circuit.

According to voltage divider rule

$$Vout = Vin \frac{R_2}{R_1 + R_2}$$
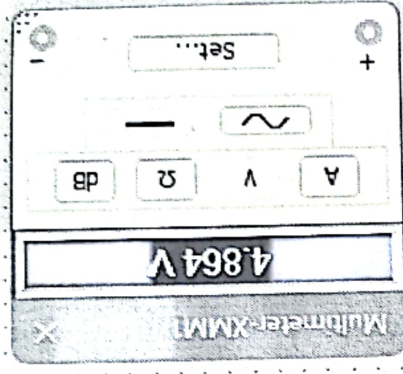
Now we connect an output load, R_3 in parallel to R_2

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.

Multimeter-XMM

5 V

A V Ω dB

~ | Set...

− +

XMM1

R1
560Ω

R2
560Ω

V1
10V
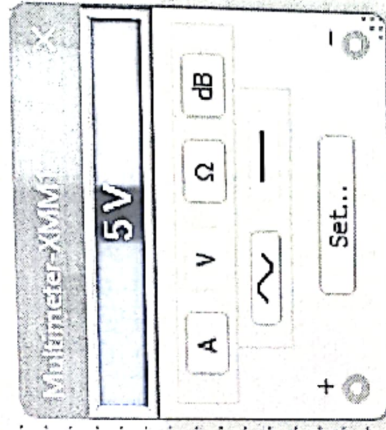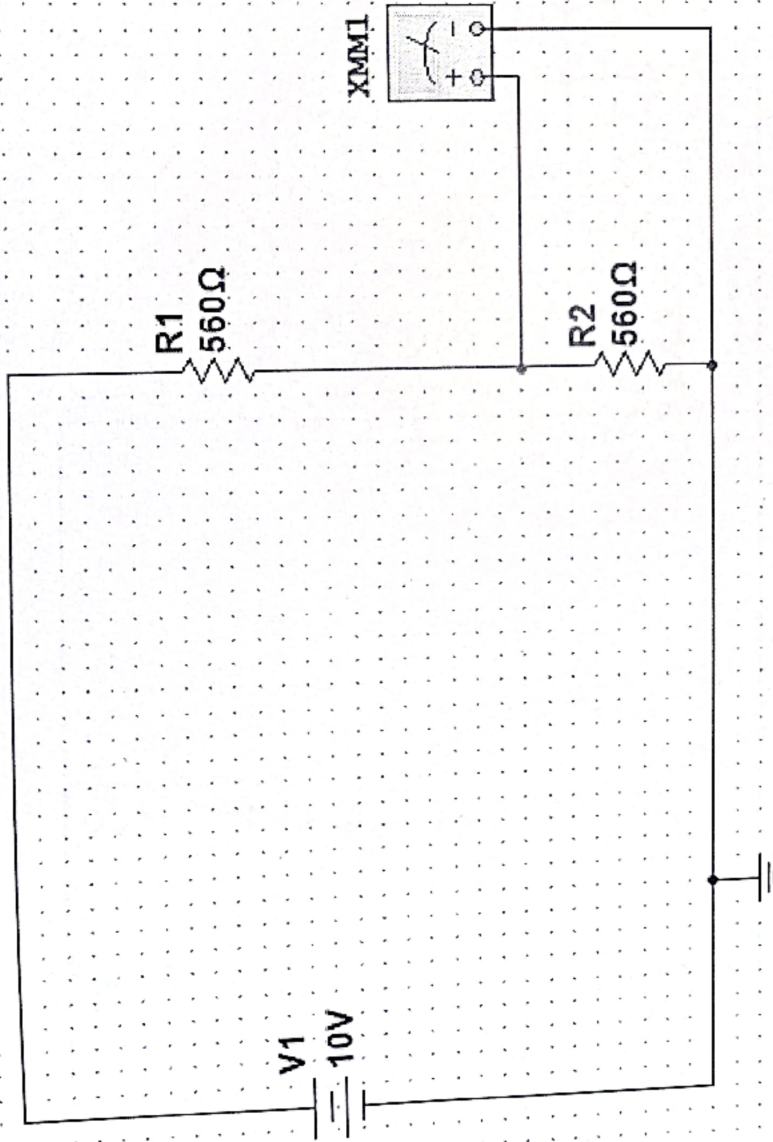
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Multimeter-XMM1 ✕

4.864 V

Set...

A   V   Ω   dB

XMM1

R3
10kΩ   100 %
Key=A

R2
560Ω

R1
560Ω

V1
10V

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Data Collection for Lab 3:

Group No. __04__
Instructor's Signature

Table 1:

| RL	Vout (Measured)	Vout (Calculated)	%Error
No resistor	5·00 V	5·00 V	0%
1k	3.94 V	3·90 V	1·02 %
4k	4·63 V	4·67 V	0·86%
7k	4·73 V	4·80 V	1·47 %
10k	4·80 V	4·86 V	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 $= 0\%$
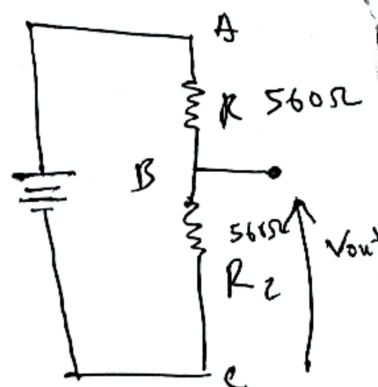
Vout (1K)

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

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

$$= 918.97\,\Omega$$

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

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

$$= 1.02\%$$

Vout (4K)

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

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

$$= 1051.22\,\Omega$$

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

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

$$= 0.86 \%$$

Vout (7K)

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

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

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

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

$$= 1.47 \%$$

Vout (10K)

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

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

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

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

$$= 1.25 \%$$

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)

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

$$R_{eq} = R_{AB} + R_{BC\,eq} = 560\,\Omega + 358.97\,\Omega = 918.97\,\Omega$$

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

Vout (4K)

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

$$R_{eq} = R_{AB} + R_{BC\,eq} = 560 + 491.22 = 1051.22\,\Omega$$

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

Vout (7K)

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

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

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

Vout (10K)

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

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

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

3. The theoretical data and experimental data are almost same. 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.

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 $(0-10K\Omega)$ variable resistor. We were also provided with a Digital Multimeter (DMM) to measure the circuit voltage of the ~~neg circuit~~ resistor:

First we took the resistors and completed the circuit in breadboard. First we measured Vout without variable resistor. After that we connected our variable resistor 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,
%o Error and lab reports

Mosroon Mofiz Arman 1921079642
- Circuit build and value cheek

Sumit Kumar Kar 2021646642
- Value check and cincuit build

Muhammad Raiyan Alam 1831100642
- cincuit build and value check