Fall 2021

EEE/ETE 141L

Electrical Circuits-I Lab(Sec-5)

Faculty : Md. Abu Obaidah (AbO)

Instructor: Farhana Atuyar Saleh

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Name:

1. Tahsin Tabassum Ali

2. Tabassoom Rahman

3. Kanta Saha

ID:

1. 2011059642

2. 2011062642

3. 2011731642

Experiment Name: Loading Effect of Voltage Divider Circuit

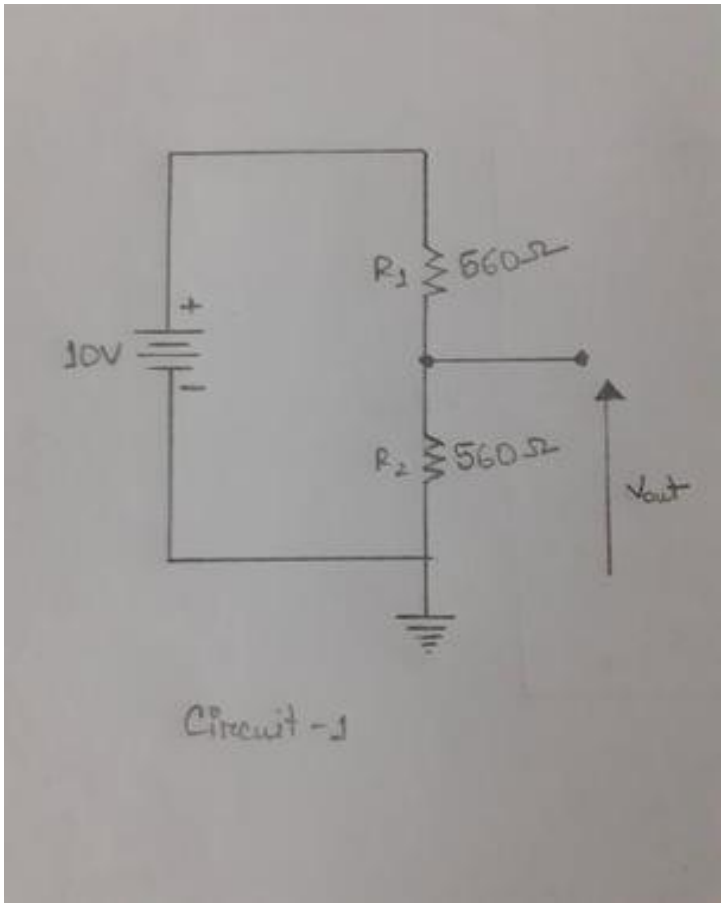
Objective:

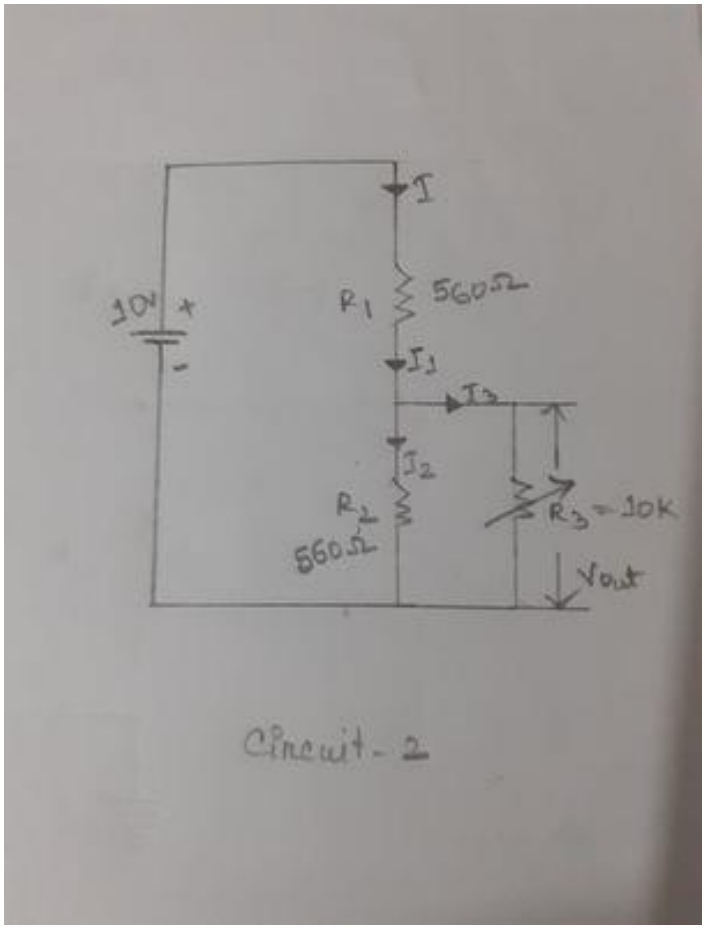
- We have to analyze how the voltage divider circuit behaves when there is no load resistance connected.
- We have to evaluate the performance of voltage divider circuit due to loading.

List of Equipment:

- Trainer Board
- DMM
- 2 × 560Ω resistors
- 1 × (0-10kΩ) variable resistor
- Multisim

Circuit Diagram:





Data Table:

Table 1:

RL	Vout (Measured)	Vout (Calculated)	%Error
No resistor	5V	5V	0%
1k	3.906V	3.91V	0.102%
4k	4.673V	4.67V	0.064%
7k	4.808V	4.81V	0.0416%
10k	4.864V	4.86V	0.082%

Results:

% Error = (Theoretical value – Experimental Value) / Theoretical Value

For no register:

RT = R1+R2 = (560+560) Ohm = 1120 Ohm
I = 10/1120 = 8.92mA
Vout = 5V

For 1k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/1000)) Ohm = (560+358.97) Ohm
= 918.97Ohm
I = 10/918.97 = 10.88mA
Vout = 3.91V
%Error = ((3.91-3.906)/3.91) * 100% = 0.102%

For 4k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/4000)) Ohm = (560+491) Ohm
= 1051Ohm
I = 10/1051 = 9.51mA
Vout = 4.67V
%Error = (|(4.67-4.673)|/4.67) * 100% = 0.064%

For 7k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/7000)) Ohm = (560+518) Ohm
= 1078Ohm
I = 10/1078 = 9.27mA
Vout = 4.81V
%Error = (|(4.81-4.808)|/4.81) * 100% = 0.0416%

For 10k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/10000)) Ohm = (560+530) Ohm
= 1090Ohm
I = 10/1090 = 9.2mA
Vout = 4.86V
%Error = (|(4.86-4.864)|/4.86) * 100% = 0.082%

Question/Answer:

1. **Explain the loading effect of your circuit (i.e explain how does your Vout vary with increasing Load resistor)**

   Answer:

   Initially the Vout was 5V, total resistance was 1120Ohm and the current flow was 8.92mA, when there was no load register.

   After adding load register the total resistance decreases so the current flow Increases.

   As the Value of the load register is increasing the value of Vout is also increasing.

   From the table when Load Resistor is 1k the Vout is 3.91 and finally when the Load Resistor is 10k the Vout is 4.86.

2. **Showing all steps in details, theoretically calculate the value of Vout for each load resistor.**

   Answer:

For no register:

RT = R1+R2 = (560+560) Ohm = 1120 Ohm
I = 10/1120 = 8.92mA
Vout = (Vin*(R2||R3))/(R1+(R2||R3)) = (10*560)/1120 V = 5V

For 1k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/1000)) Ohm = (560+358.97) Ohm
= 918.97Ohm
I = 10/918.97 = 10.88mA
Vout = (Vin*(R2||R3))/(R1+(R2||R3)) = (10*358.97)/918.97 V = 3.91V

For 4k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/4000)) Ohm = (560+491) Ohm
= 1051Ohm

I = 10/1051 = 9.51mA
Vout = (Vin*(R2||R3))/(R1+(R2||R3)) = (10*491)/1051 V = 4.67V

For 7k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/7000)) Ohm = (560+518) Ohm
= 1078Ohm
I = 10/1078 = 9.27mA
Vout = (Vin*(R2||R3))/(R1+(R2||R3)) = (10*518)/1078 = 4.81V

For 10k register:

RT = R1+(R2||R3) = 560+((1/560) + (1/10000)) Ohm = (560+530) Ohm
= 1090Ohm
I = 10/1090 = 9.2mA
Vout = (Vin*(R2||R3))/(R1+(R2||R3)) = (10*530)/1090 = 4.86V

3. **Comparing the theoretical data to the experimental data, comment how far the loading effect of your circuit supports the theory.**

   Answer:

   According to the Data table, Our Percentage error for,

   1k is 0.102%

   4K is 0.064%

   7k is 0.0416%

   10k is 0.082%

   Therefore, from all these percentages, errors are minimal percentage errors we can clearly said that, our loading effect supports the theory.

Discussion:

From the lab 3, we learned about Voltage divider circuit and Loading effect.

As, it was an online lab, we had to use multisim to do the experiments. So, we didn't have to face many errors or faults. We could find the theoretical values easily.

If we would have done the lab offline, we could have faced many errors such human errors, environmental errors or mechanical errors. Also, we could have faces errors using DMM, cables, breadboard connection etc.