ELECTRONICS (ETEN1000)

STUDENT NUMBER: **22663281**

NAME: **Dhrubo Jouti das Troyee**

GROUP: **Tashi Lhadon** **August 1, 2024, 12:00 to 2:00 pm**

LABORATORY: **Lab 1: Equipment Familiarisation**

LABORATORY SUPERVISOR: **Mr. King Su Chan**

LABORATORY PARTNERS: Tashi Lhadon

DATE PERFORMED: 01.08.2024

DATE DUE: **08.08.2024**

DATE SUBMITTED: **5.09.2024**

I hereby declare that the calculation, results, discussion and conclusions submitted in this report is entirely my own work and have not copied from any other student or past student.

Student Signature: ______________________

Equipment Familiarization

INTRODUCTION

This lab is designed to introduce students with the basic electronic measuring instruments used in electrical engineering, such as the function generator, digital multimeter (DMM), digital storage oscilloscope (DSO), and power supply unit (PSU). For accurate measurement and analysis of electrical signals in a variety of circuits, this equipment is necessary.

AIM

The aim of this lab is to familiarize students with the use of basic lab tools and develop the knowledge required to create basic circuits on a breadboard, measure and analyze voltages, currents, and waveform signals in basic electronic circuits using an oscilloscope.

SUMMARY

Students will have successfully learned how to utilize basic electronic measurement tools by the end of this lab, accurate measurement and analysis in future studies can be improved by the practical expertise gained from utilizing these tools.

CIRCUIT

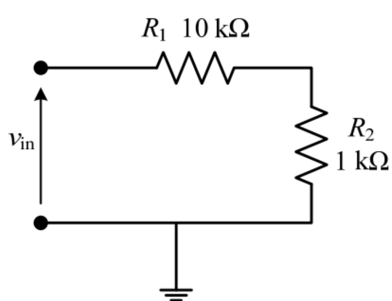

FIGURE :1

A simple circuit has been established in series by using two resistors (10 KΩ and 1K Ω) and two different cleaned wires on a breadboard, as displayed in the above image.

RESULTS

3.1

V_{R1} **= 4.520** V
V_{R2} **= 0.430** V
V_{in} **= 5.045** V

3.2

Current = 0.4555 mA

3.3

Peak voltage = 5V

3.4

(a) Voltage across R2:
Measured by the oscilloscope = 0.438 V_{p-p}

(b) Input voltage:
Measured by the oscilloscope = 5 V_{p-p}

(c) Period of the waveform measured using the oscilloscope = 1.025 ms

DISCUSSION

The experimental and theoretical results are compared in the following sections.

3.1

Experimental

Voltage in R1, V_{R_1} = 4.520V

Theoretical

$$V_{R_1} = \left(\frac{R1}{R1+R2}\right) Vin$$

$$V_{R_1} = \left(\frac{10\ \text{K}\Omega}{10\text{K}\ \Omega + 1\ \text{K}\ \Omega}\right) \times 5\ V$$

$$V_{R_1} = \left(\frac{10\ \text{K}\Omega}{11\ \text{K}\ \Omega}\right) \times 5\ V$$

$$V_{R_1} = 4.545\ \text{V}$$

Experimental

Voltage in R1, V_{R_2} = 0.430 V

Theoretical
$V_{in} = V_{R_1} + V_{R_2}$
$V_{R_2} = V_{in} - V_{R_1}$
$V_{R_2} =$ 5 V - 4.545V = 0.455 V

Experimental
Total voltage = 5.045 V

Theoretical
$V_{in} = V_{R_1} + V_{R_2}$
$V_{in} = 4.545 \text{ V} + 0.455 \text{ V} = 5 \text{ V}$

3.2

Experimental
Current = 0.4555 mA

Theoretical
Using Ohm's Law,
$V = IR$
$I = \frac{V}{R}$
$I = \frac{5V}{11000\Omega}$
$I = 0.000454 \text{ A} = 0.454 \text{ mA}$

3.4

(a)

Experimental
Measured by the oscilloscope V_{R_2} = 0.438 V_{p-p}

Theoretical
$V_{in} = V_{R_1} + V_{R_2}$
$V_{R_2} = V_{in} - V_{R_1}$
$V_{R_2} = 5\,V - 4.545 \text{ V}$
$V_{R_2} = 0.455 \text{ V}$

(b)

Experimental
Measured by the oscilloscope V_{in} = 5 V_{p-p}

Theoretical
$V_{in} = I \times R_{Total}$
$V_{in} = 0.454 \times (1000\Omega + 10000\Omega)$
$V_{in} =$ 5V

COMPARISON

	Experimental	Theoretical
V_{R_1}	4.520 V	4.545 V
V_{R_2}	0.430 V	0.455 V
V_{in}	5.045 V	5V
Current	0.4555 mA	0.454 mA
V_{R_2} (oscilloscope)	0.438 V	0.45 V
V_{R_1} (oscilloscope)	5V	5V

Figure 2: Comparison between Experimental value and Theoretical Value

Post-Laboratory

Q6.1. Typical Sources of Measurement Errors

It was challenging to record a constant result when measuring resistance with the digital multimeter (DMM) because of the readings' fluctuations, particularly after the decimal point. It was necessary to take an approximate average based on several observations due to this variability. Like that, it was difficult to precisely align the waveform with the gridlines when utilizing the digital storage oscilloscope (DSO), which could have led to mistakes in the measurements of voltage and time. Any misalignment would result in inaccurate data when estimating the waveform's peak, which involved counting the grid divisions and multiplying by the voltage figure displayed.

Q6.2. comparison of DC measurements between DSO and DMM

In most cases, a digital multimeter (DMM) can do DC measurements more accurately than a digital storage oscilloscope (DSO). DMMs are made especially for precise and stable DC measurements, when working with steady signals, it offers higher accuracy, better resolution, and less fluctuation. Due to its optimization for such static measurements, DMMs are perfect for measuring DC voltage, current, and resistance.

However, DSOs are less appropriate for accurate DC measurements since its main objective is to record and show dynamic or time-varying signals. DSOs have limits when it comes to measuring DC, such as increased noise sensitivity, less precise resolution for constant signals, and possible display fluctuations that could lead to unstable readings.

In summary, it can be said that a DMM's design and accuracy make it more trustworthy for DC measurements, but a DSO, though capable, is not as precision and is better suited for dynamic waveform visualization.

Q6.3. relationship between the voltage and current of a resistor

According to Ohm's law, ***V=IR***, where ***V*** is the voltage of the resistor, ***I*** the current passing through the resistor and ***R*** the resistance of the resistor. It can be seen that Voltage is directly proportional to Current passing through the resistor ***(V ∝ I).***

This relationship usually remains true for real resistors under typical operating conditions. However, restrictions apply when excessive voltage/current levels, temperature, or tolerance are involved. A real resistor's resistance can change as temperature rises, impacting current flow. The real resistance value of resistors may differ slightly from the supposed value due to manufacturing tolerances. Ohm's Law may not apply to all resistors because of unpredictable behaviours at very high currents caused by material limits.

Q6.4

Series circuit connected to a $6\ V_{DC}$ power source

A flashlight, or torch, is an easy example of a series circuit connected to a $6\ V_{DC}$ power source. This ensures that the whole voltage is supplied across the single bulb since the power source and bulb are connected in series. For best brightness with a single bulb, the following setup is perfect.

V = 6 V
R = 9 Ω (4-Watt bulb)
I = 0.66 A

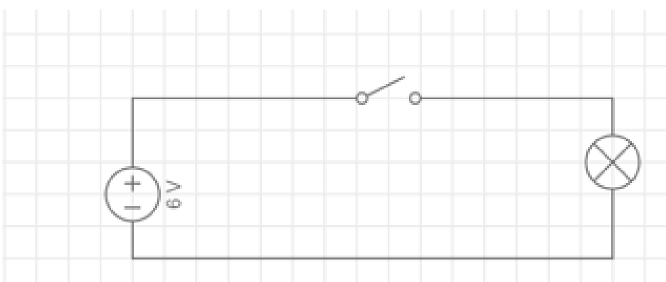

Figure 3: circuit connection in series to a $6\ V_{DC}$ power source

Parallel circuit connected to a $6\ V_{DC}$ power source

Car headlights are a typical example of a parallel circuit that is powered by a 12 VDC source. Because each headlight in a parallel circuit is connected to the power source separately, both lights can continue to function even in a situation that one does not work. By connecting them in parallel, the headlights can function independently of one another and receive the entire 12 V.

Example:

The headlights on an automobile are made up of 24-watt bulbs with a 6 Ω resistance, each requiring 2 A of current for a total of 4 A.

V = 12V
P =24-Watt bulb
I = 4A
$R_1 = R_2 =$ ***6 Ω***
$I_1 = I_2 =$ ***2 A***

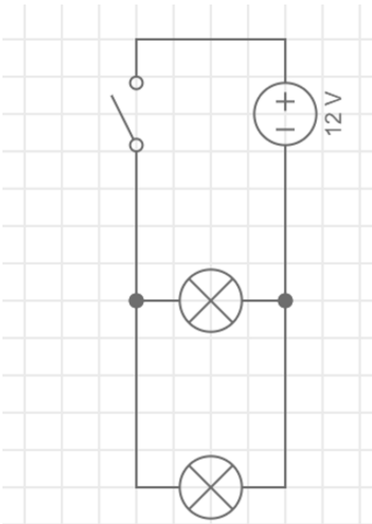

Figure 4: circuit connection in parallel to a $6\ V_{DC}$ power source

CONCLUSION

In conclusion, it can be said that compared to the theoretical calculations, the experiment's results showed an accuracy rate of approximately 98.53%, indicating remarkable accuracy. Most of the variances were in decimal numbers, and they were minor and within the acceptable limits. Overall, the expected results were successfully achieved, highlighting the efficiency and reliability of the instruments and measuring methods employed in the laboratory.

APPENDICES

NIL

REFERENCES

NIL