ECEN 214-302 – Electric Circuit Theory

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Summer 2020

Lab 1: Introduction to Electrical Measurements

**Submitted by:**

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| **Table 1.** UIN, names, and section numbers. | | | |
| **Student Name** | **UIN** | **Section #** | **Group #** |
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**Date Performed: June 4th, 2020**

I. Objective

The purpose of the lab is to become familiar with the voltage divider and becoming familiar with making measurements using the PMD device.

II. Procedure

Materials

* 1.5 volt battery holder
* Selection of ¼ W resistors
* Breadboard
* 1.5 V battery
* PMD
* Red and black jumper cables

Task One-DC Voltage Measurement

1. Collect materials given above.
2. Open the Waveform Generator on the Waveforms program.
3. Place the 1.5 V battery into the battery holder.
4. Place the leads of the battery holder into the positive and negative strips of the breadboards.
5. Place the positive and negative leads of the voltmeter into the positive and negative strips on the breadboards.
6. Take a screenshot of the screen of the voltmeter.
7. Record the voltage measurements at least 3 times

Task Two-AC Voltage Measurement

1. Collect the PMD and the bread board.
2. Open the Waveform Generator on the Waveforms program.
3. Set signal to AC and set the frequency to 200 Hz.
4. Set the peak-to-peak voltage to 2V and the offset to 0V.
5. Place the leads of the Waveform Generator into the positive and negative strips of the breadboard and place the leads of the voltmeter and measure the voltage at least three times.
6. Change the peak-to-peak voltage to 4V and repeat steps 4 to 5.
7. Change the function generator to produce a square wave and peak-to-peak voltage back to 2V.

Task Three-Measuring Resistance with a Voltmeter

1. Choose a 1 kilo-ohm resistor for R1 and a random resistor for R2.
2. Place R1 and R2 in series with each other in the form of a voltage divider.

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1. Set the Voltage Source of the PMD to 5V and place the leads to the positive and negative strips of the breadboard and connect the positive strip to R1.
2. Measure the voltage across the R2 resistor using the voltmeter leads of the PMD and call it V2.
3. Use the data collected to find the unknown resistor known as R2.

III. Difficulties

I had found that the first battery I chose had very low voltage, so I had to choose the other 1.5V battery. I also found that when I used the voltmeter on the PMD the voltage measurement would alternate up and down about 0.001 volts.

IV. Results

Task One

For task one I measured the voltage of a 1.5 battery in its battery holder. Therefore, there is resistance not considered in the measurement.

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**Figure 2.** Voltage measurement of 1.5V battery.

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| --- | --- | --- | --- |
| **Table 2.** Voltage measurements | | | |
| Voltage(V) | 1.586 | 1.586 | 1.586 |
| Avg | 1.586 | | |

The measured voltage of the battery in the battery holder is 1.586V.

Task Two

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**Figure 3.** AC voltage of function generator.

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| --- | --- | --- | --- |
| **Table 3.** Function generator AC voltage measurements. | | | |
| Wave | sine | sine | square |
| Peak-to-peak voltage(V) | 2 | 4 | 2 |
| AC voltage(V) | 0.708 | 1.416 | 0.987 |
| calculated | ± | ± | ±1 |

Sine wave:

Task Three

|  |  |
| --- | --- |
| **Table 4.** Voltage measurements of voltage divider. | |
| V1(V) | 5.019±1mV |
| V2(V) | 2.502±1mV |
| R1(Ω) | 1,000±1% |
| R2cal(Ω) | 994.04±9.94 with a 0.586% error |

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V. Conclusion

The goal of the experiment was to learn to use the PMD functions like the voltmeter and the function generator. A secondary goal was to use propagation of error to calculate the uncertainty of an unknown variable. I used multiple measurements to get around the oscillation of the voltage during measurement. I had to also use the method of propagation or error to find the uncertainty of an unknown variable.