ECEN 214 Lab 1

Introduction to Electrical Measurements

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Section 502
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Procedure

First you will measure the voltage of a standard 1.5 V battery with a breadboard and voltmeter. The measured voltage may be different than 1.5 due to the life of the battery. Then you will use the Waveform Generator in the PMD to produce an AC voltage source and measure the voltage with a voltmeter. Set the sine wave peak to peak equal to 2V and measure the voltage, then 4V and measure. Then use the square wave and set the peak to peak equal to 2 V and measure.

Finally you will measure the voltage across 2 resistors in a circuit with only one of the values of the resistors known. Measure the value of the voltage of the battery, the resistance of one of the resistors, and the voltage drops across both of the resistors. You will use the standard voltage divider equation to figure out the resistance of the other.

Data Tables

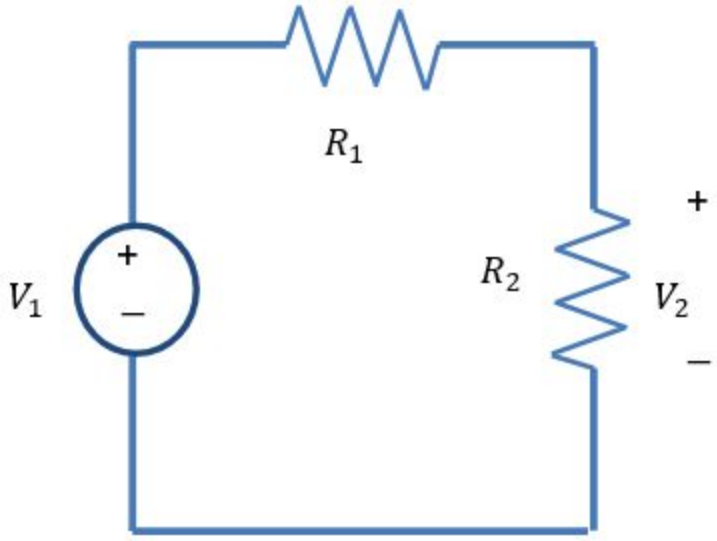
Task 1

	Channel 1	Channel 2
Voltage (V)	1.54	1.543
AC rms (V)	.001	.001

Task 2

Peak to Peak: 2V; Sine Wave	.706 V
Peak to Peak: 4V; Sine Wave	1.41 V
Peak to Peak: 2V; Square Wave	.998 V

Task 3



R_1 = 1000 Ω ± 5% (50 Ω)

V_1 = 1.828 ± .0005 V

R_2 = Unknown (Calculated in Sample Calculations)

V_2 = 1.644 V ± .0005 V

Sample Calculations

Task 3

The standard voltage divider equation that can give us the value of R_2 is this:

$$V_2 = V_1 \frac{R_2}{R_1+R_2}.$$

Therefore $R_2 = V_2 * R_1 / (V_1 - V_2)$

$R_2 = 1.644 * 1000 / (1.828 - 1.644)$

$R_2 = 8934.8$ Ω

Expected Error

To calculate the expected error we can calculate the largest possible value of R_2 and the smallest possible value of R_2 and subtract the two.

Largest R_2 = 1.6445 * 1050 / (1.8285 - 1.6445) = 9384.4 Ω

Smallest R_2 = 1.6435 * 950 / (1.8275 - 1.6435) = 8485.5 Ω

Largest - Smallest = 9384.4 - 8485.5 = 898.90 Ω

898.9 = 8934.8 * .10061

R_2 = 8934.8 ± 10.061%

Discussion

Channel 1 recorded the voltage of our battery to be 1.54 V and channel 2 recorded it to be 1.543 V. The voltmeter measured the voltage of our battery to be 1.543 V. This means is is accurate to 3 decimal places and has an error value of ±.0005 which is .032% of the total reading. We can record our measurement as 1.543±.032%.

When our peak to peak amplitude was set to 2 V for task two our reading for the AC voltage was not anywhere near 2 V. This is because it is alternating current meaning that the voltage will peak at 2 V, but it will not always be at 2 V, giving it a different reading. The voltage will actually be approximately Amplitude divided by the square root of two.

When we changed the function generator to a square wave our voltage went up and was different than that of the sine wave. This is because a square wave produces a

different rms voltage than the sine wave. It should be approximately the amplitude of the square wave.

Conclusion

In this lab we have learned about the basics of using lab equipment and taking measurements. We also got see first hand the effects of some of these concepts that we learn in lecture such as Ohm's law and the voltage divider equation. We also learned how to use a breadboard so that in future labs we will be able to navigate them and the rest of the lab equipment with ease.