

The City College of New York

EE 22100 EE Lab1

Experiment 1: Introduction of Measurement Equipment

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Objective

The purpose of this experiment is to familiarize the laboratory equipments. The equipments are: Breadboard, Resistors, DC Power Supply, Digital Multimeter, Function generator and Digital Oscilloscope.

Background

The lab will allow us to explore the tools and equipments on this lab. It will also explore the fundamentals of a circuit. The first part of the lab is to build a basic circuit and do circuit analysis to find the voltage at certain nodes with the given voltage input, resistor values, and voltage nodes. We will also find the voltages using the digital multimeter in order to prove the Ohm's law. The Ohm's law tells us that voltage is the product of current and the resistances. The second part of the lab involves using the oscilloscope and function generator. We will be measuring the maximum and minimum voltages, peak voltages, peak to peak and offset voltage using the oscilloscope.

Procedure

Part A

The first step involved us finding a 1k resistor and one 100 resistor using the color code. We placed the two resistor on the breadboard using the figure A. The output and the ground of the power supply is connected also in the same manner following the figure A. Then we set the voltage of the power generator to 12V. In order to find the voltages at the end, we put the LO connection to the ground and the HI connection at each node. We connected the HI and LO connection on each side of the resistor in order to get the voltage difference. To find the current, we select the ammeter mode on the multimeter. We must connect the multimeter in series to the

circuit. So we open the second resistor end and connect one end of the multimeter lead and the other end of the multimeter lead to the ground.

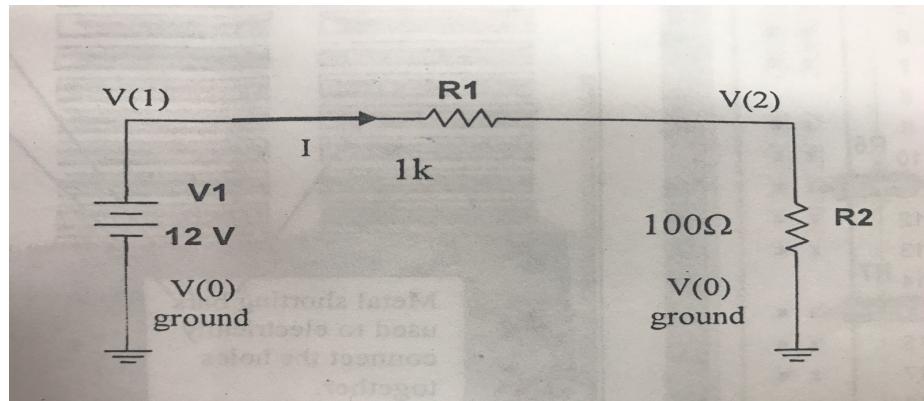


Figure 1.DC Measurements

Data 1:

Table 1

Theoretical Voltage (V)	Measured Voltage (V)	Percentage Error
$V(1) = 12$	11.997	0.025%
$V(2) = 1.0909$	1.1065	1.43%

2.What happens if you switch the meter ports(i.e. The LO and HI cables are switch)?

→ Get negative values

Table 2

	Theoretical Voltage (V)	Measured Voltage (V)	Percentage Error
V_{R1}	10.909	10.892	0.155%
V_{R2}	1.0909	1.10	0.827%

Table 3

Ohm's Law Calculation	Measured Current	Percentage Error
0.010909	.009835	9.845%

Table 4

Color Code Value	Measurement	Percentage Error
1k	981	1.9%
100Ω	99.3	0.7%

Part B:

For the second part we used two 82 resistors and function generator in series with each other. The function generator acts as a AC source and a DC source with a 50 ohms resistor. We set the frequency to 1.25kHz, and the voltage offset to .5V, Vpp to 1 volts. Then used the oscilloscope to measure certain values on the circuit.

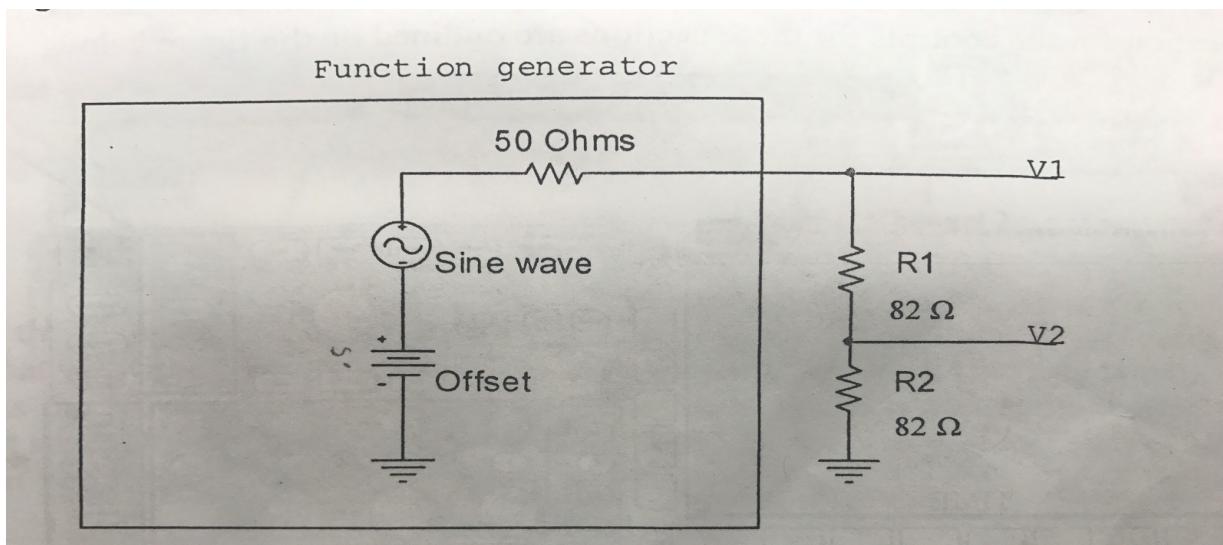


Figure 10: Circuit used to form the signals that will be displayed on the oscilloscope.

Measurement Data

Table 5

	Calculated(V)	Measured (V)
V_{Max1} (top of waveform)	1.5	1.54
V_{Min1} (bottom of waveform)	0	-.060
V_{Max2} (top of waveform)	0.75	.860
V_{Min2} (bottom of waveform)	0	-.020m
V_{P1} (ac component)	.75	.780
V_{P2} (ac component)	.375	.440
V_{PP1} (ac component)	1.5	1.64
V_{PP2} (ac component)	.75	.880
V_{RMS1} (ac component)	.53	XXXXXXXXXXXX
V_{RMS2} (ac component)	.265	XXXXXXXXXXXX
$V_{Offset1}$ (dc component)	.75	.813V
$V_{Offset2}$ (dc component)	.375	.455V

Question

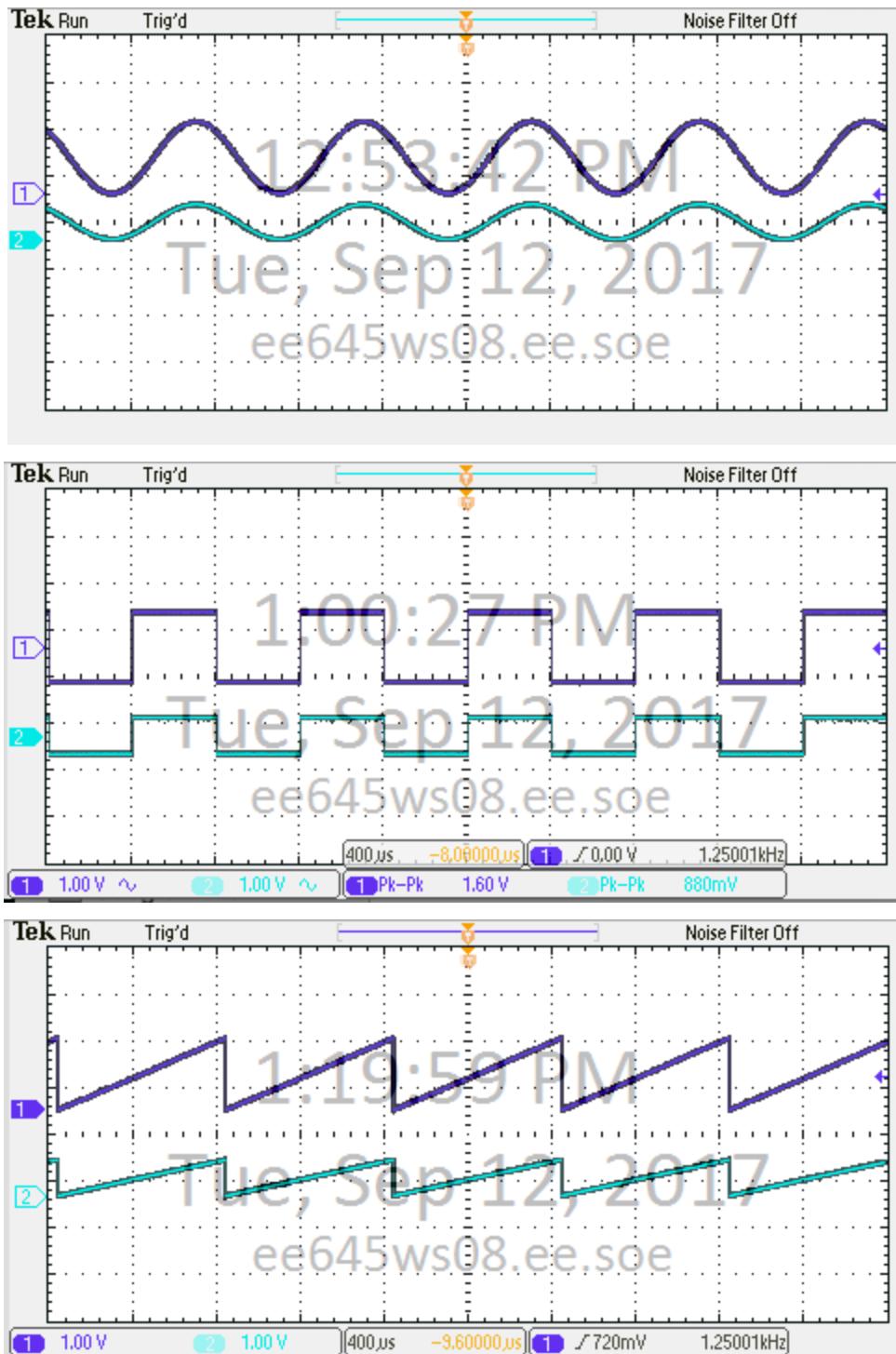
a) Change the frequency of the function generator to 100kHz then adjusts the oscilloscope so that the screen shows several cycles of the sine wave. What is the new setting for time per division?

→ 4 us/div.

b) Change the amplitude of the function generator to and then adjust the oscilloscope so that the screen shows the top and bottom of the sine wave. What is the new setting for volts per division?

→ 2.00 V.

- c) Change the waveform to square and triangular wave and note the waveform on the oscilloscope display.



Conclusion

This lab was a good introductory lab that helped us understand the equipments of the lab. In this lab we were able to learn how to use the digital multimeter, breadboard, oscilloscope, and function generator. We learned how to read the color coded resistors. By using the multimeter we were able to compare our results from the circuit analysis to the measured values. Since the measured values were close to the values we got from the Ohm's Law, we can validate the Ohm's Law. The errors could be from the wires and the probes of the equipments we were using. There could have been a slight resistance on those wires that's why we couldn't get the accurate result.