Physics 320 - Fall 2017
LAB 3 - Introduction to the Function Generator and Oscilloscope

Objectives: Be able to build a simple voltage divider, use a function generator to produce a time-dependent signal, and use an oscilloscope to measure a time-dependent signal.

To Turn In: The lab sheet with the specified information and the answers to the questions. You should do the lab in your notebook and only transfer final data and answers to your data sheet when you are happy with it.

Part 0 - Understand the Equipment

Study the various knobs and connections on the function generator. Try to determine what they do. Pair up and take turns explaining the functions to each other. If there are an odd number of students, the instructor will pair up with the odd person.

Do the same for the oscilloscope. Please refer to the handouts on oscilloscopes.

Part 1 - The Function Generator

Measure the sine wave output of a function generator using a DMM and an oscilloscope. Adjust the amplitude of the signal so it is between 5 and 10 V peak-to-peak. Then calculate the ratio of the DMM and scope values. (Note: The DMM may not be able to measure the full frequency range. Measure what you can.) You will need to trigger the scope correctly and measure the amplitude of a signal. The amplitude is one half the peak-to-peak value in the vertical direction. You will find it is easier and more reliable to measure the peak-to-peak value and divide by 2 than it is to measure the amplitude directly. Perform the measurements for the following nominal frequencies (i.e. the value on the function generator knob): 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz. Measure the actual frequencies using the scope - do not just accept the nominal value. Fill in the table on the lab sheet.

Repeat the above measurements for a smaller amplitude value, less than 2 V peak-to-peak on the scope.

Part 2 - The Voltage Divider

Construct three voltage dividers on a protoboard. The first divider should have two 1 kΩ resistors, the second divider should have two 1 MΩ resistors, and the third divider should have one 1 MΩ and one 3 MΩ resistors with the 3 MΩ resistor being the second half of the divider. Measure the actual resistance of the resistors. As you saw in the first lab, the nominal value may not be very precise. Make sure you draw a schematic of each circuit in your lab notebook and reproduce the circuits on the lab sheet where indicated.

Connect a ∼ 5 V power supply to the dividers. Measure the input and output voltages of the dividers using the DMM. This is the DC result. Now replace the power supply with a function generator set so the amplitude is ∼ 5 V. Using the oscilloscope, measure the voltage input to and output from the dividers for the following nominal frequencies: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz. Fill in the table on the lab sheet.

Name_____

Date_____

Data Sheet for Electronics Lab 3 - Introduction to the Voltage Divider and Oscilloscope

Part 1 - The Function Generator

frequency	DMM reading	o'scope reading	ratio	frequency	DMM reading	o'scope reading	ratio

Determine the ratio between the DMM and the scope for the middle frequencies, 1 kHz and 10 kHz. If the ratio is not close to 1, explain why. Show that your explanation reconciles the numbers. In other words your explanation should lead to a conversion method to go from one instrument to the other.

Part 2 - The Voltage Divider

Draw the for voltage divider 1 circuit for voltage divider 1 here (give values for resistances):

frequency	input V	output V	ratio (measured)	ratio (theory)

Draw the circuit for voltage divider 2 here (give values for resistances):

frequency	input V	output V	ratio (measured)	ratio (theory)

Draw the circuit for voltage divider 3 here (give values for resistances):

frequency	input V	output V	ratio (measured)	ratio (theory)

Discuss how well each voltage divider worked. Did they perform as expected? Your answer should be at least a paragraph long and use complete sentences.