INTRODUCTION TO AC SIGNALS

Alternating Current (AC) signals are characterized by several parameters among which the most important are: Type of Waveform, Amplitude and Frequency. In this lab, we will explore two instruments that are typical of any Electronics Laboratory and widely used for testing and characterization of circuits: The Function Generator and the Oscilloscope.

1.- The Oscilloscope

The oscilloscope is an electronic instrument used to visualize signals in the time domain using the screen. The horizontal axis represents time (seconds) while the vertical axis represents that amplitude (Volts) of the signal at any given instant of time.

The figure below shows a diagram of one of the analog oscilloscopes in the lab. The lab also has several digital oscilloscopes but it is a good idea to start with the analog oscilloscopes as they are easier to master.

![Oscilloscope Diagram]

Most oscilloscopes have two channels labeled Channel 1 and Channel 2. When testing circuits, Channel 1 normally visualizes the input signal while Channel 2 normally visualizes the output signal.
The screen of the oscilloscope is split into several divisions: 8 vertical main divisions and 10 horizontal main divisions. By counting horizontal divisions

We can calculate the time between two events by counting the number of horizontal divisions between the two events and multiplying it by the value indicated by the Timebase Selector knob. Similarly, we can calculate the amplitude of a signal by counting the number of vertical divisions and multiplying this value by the value indicated by the Input Channel Gain knob.

1.1 Calibration signal in oscilloscope

Oscilloscopes also include a calibration signal that is used to ensure that all the controls in the instrument are working correctly.

1.1.1.- Locate the calibration signal output in your oscilloscope. The manufacturer also writes, close to the output of the signal, the amplitude and frequency of the calibration signal. Write these values down:

   Calibration signal specifications:
   Waveform:
   Amplitude:
   Frequency:

1.1.2.- Connect the calibration signal to the oscilloscope. Measure the amplitude and frequency of the signal:

   Measured amplitude:
   Measured frequency:

If the difference between the specified and measured values is too high, this is normally a sign that the oscilloscope is configured incorrectly.

2.- The Function Generator.

This instrument is used to generate or synthesize electrical signals of different shape, amplitude and frequency that are used to characterize electronic circuits.

The figure below shows a diagram of the main control knobs of one of the Analog Function Generators available in the electronics lab. Although some workbenches also have a digital function generator it is also a good idea to start with the analog one as it is easier to master.
This function generator, like most function generators has two outputs. One is labeled TTL and the other 50 Ω. The 50 Ω output is normally used for analog circuits while the TTL output is typically used when testing digital circuits.

2.1 Connect the 50 Ω output to the input of the oscilloscope. Experiment with the different controls of the function generator. Explain in your own words, what is the function of the following controls in the function generator as they are labeled above. Keep in mind that some controls are only active when pulled out as indicated by the manufacturer:

(1):

(3):

(10):

(8):

(7):

(9):
2.2 Configure the function generator for:

Sinusoidal signal;
AC Amplitude equal to 6.3 Volts
DC Offset equal to 1 Volt
Frequency equal to 980 Hz

Verify the correct configuration by connecting the function generator to the oscilloscope.

2.3 Other Oscilloscope controls

In addition to the basic oscilloscope controls explained here, the oscilloscope has several additional controls that are useful when dealing with more complex signals. You will learn about them in future labs and future courses. Keep in mind, however, that if the oscilloscope is incorrectly configured, it may be difficult to visualize any signal.

Keep the function generator as in the activity 2.2 before. While one of the students in the group is not looking, the other student should change the positions of the knobs and control until the signal disappears. The student that was not looking should configure the controls so the signal appears again on the screen of the oscilloscope.

When this is done, change roles with the other student and repeat the experience.

2.4 External influences

While keeping the cable connected to the oscilloscope, disconnect the cable from the function generator. Grab, with one hand, the red lead. Measure the frequency and amplitude of the signal shown in the oscilloscope.

Can you explain where this signal is coming from? Where is the most important clue about this signal?

3.- Write an individual laboratory report for this activity. Follow the guidelines and examples that are available in the EET 105’s website. Take into account the suggestions and feedback from the instructor for past labs.