ECE 327: Electronic Devices and Circuits Laboratory I

Procedure for Lab 0 (Instrumentation Refresher Lab)

Complete the following with the other students at your table.

Function generator and oscilloscope

1. Generate 5 V peak-to-peak (i.e., 2.5 V amplitude) 1 kHz triangle wave with your function generator.
   - New models: Use Utility Output Setup High Z DONE and then turn Output on.
   - Use Normal output to generate a Ramp.
   - Make sure Duty Cycle or Symmetry is set to 50%.
     - Old models: Vernier (ver-nee-er) knob adjusts if pulled out and locks to 50% otherwise.

2. Acquire waveform on the oscilloscope using 1:1 coaxial cable or probe.
   - Press Auto-Scale to see the signal.
   - Select channel (i.e., press 1 or 2).
     - Make sure Probe soft button is set correctly (i.e., set to 1:1).
     - Turn channel display off and on by selecting channel again and again.
   - For help on buttons, hold them down until dialog box appears.

3. Change oscilloscope’s Horizontal divisions by adjusting large knob at top of panel.
   - Repeat after turning on Vernier in the Main Delayed settings. Effect?

4. Change oscilloscope’s vertical divisions by adjusting knob above channel button.
   - Repeat after turning on Vernier in the channel settings. Effect?

5. Change channel’s vertical position by adjusting knob below channel button.

6. Use the oscilloscope’s Quick Meas feature to verify Peak to Peak and Frequency of the waveform.

7. Change function generator’s Duty Cycle or Symmetry to generate sawtooth wave.

8. Using the sawtooth input, experiment with the oscilloscope Trigger settings under Edge
   - Explain what the trigger Edge Level does.
     - Select rising edge and then adjust trigger Level.
     - Select falling edge and then adjust trigger Level.
   - Move the Level outside of the waveform’s −2.5 V-to-2.5 V envelope. What is the effect?
     - In this case, determine what Run Stop does.
     - With Run/Stop set to run (i.e., button is green), determine what Single does.
     - With Run/Stop set to stop (i.e., button is red), determine what Single does.
     * In other words, press it again and again.

9. Ask the instructor to verify that your results are correct.
Using the 10:1 probe

10. You can find the 10:1 probes in the *zipper pouch* above your oscilloscope.
   - These probes have been *calibrated* for each scope.
   - These probes should *never* leave the bench.

11. Acquire waveform using 10:1 probe. Make sure the **Probe** setting is still at 1:1. What is the impact?

12. Change the **Probe** setting to 10:1 (i.e., the *correct* value for this probe).
   - These oscilloscopes *can* automatically determine probe setting if special probes are used.
   - Age has degraded the oscilloscope’s ability to properly determine probe setting.
     - If the scope detects an **AutoProbe**, it will override your settings.
     - The scope’s **AutoProbe** choice is often incorrect.
     - Small pieces of paper have been placed over oscilloscope inputs. They prevent the automatic probe detection. **DO NOT REMOVE THEM**!
     - You will *always* use the 10:1 probes, so your **Probe** setting should be always be set to 10:1.
     - **NEVER** connect the coaxial end of the 10:1 probes to the function generator.

13. Again, use the **Quick Meas** feature to verify amplitude and frequency of waveform.

14. Determine the purpose of the orange **Ref** button on the 10:1 oscilloscope probe.

15. **Ask the instructor to verify that your results are correct.**

DC power supply


17. Generate 10 \(V_{DC}\) and \(-10\ V_{DC}\) signals from your *DC power supply*.

18. **USING A BANANA CONNECTOR**, connect the 0 V (i.e., “ground”) reference on the DMM (i.e., “digital multimeter”) to the 0 V reference on the power supply. **You should be able to “plug” both ends of the banana connector in without any additional wires.** Note that breadboards usually have built-in female banana connectors for frequently connecting and disconnecting power supplies.

19. Using another banana connector and your DMM, verify the 10 \(V_{DC}\) and \(-10\ V_{DC}\) signals.

20. Using two separate 10:1 probes, view the 10 \(V_{DC}\) signal on channel 1 of the oscilloscope and the \(-10\ V_{DC}\) signal on channel 2 of the oscilloscope.

21. Watch the signals as you adjust power supply knobs. Determine the purpose of the **Tracking** knob.

22. **Ask the instructor to verify that your results are correct.**

Graded portion of lab

23. Clean up. You get a clean-up grade for today.
   - Place your 10:1 oscilloscope probes in the *zipper pouch* above the oscilloscope.
   - **DO NOT** hang your 10:1 oscilloscope probes with the other laboratory cables.
   - The 10:1 oscilloscope probes **MUST STAY AT THE TABLE**.