

# CS 4330/6330 – Microprocessor-based Embedded Systems

## Lab 1 – Lab Familiarization

### Learning Objectives

- Learn the equipment and procedures used in the CEG 4330/6330 Laboratory

### Overview

In this lab, you are going to get familiar with the usage of the Arduino IDE, oscilloscopes, and function generators. To complete this lab you must download the Arduino IDE to program the Arduino.

Keep all of your source code. They are needed later on for system integration.

### Equipment Familiarization

Connect the UNO to a USB port of the PC. Use the Arduino IDE example Blink (by using Menu: File > Examples > 01. Basics > Blink) to flash the on-board LED. No need to demonstrate this code.

Modify the Blink code by replacing both `delay(1000)` function calls with `delay(2)`. Connect pin 13 (and ground) to an oscilloscope channel and observe the resulting square wave. Measure and record the square wave frequency and duty cycle which should be displayed on the oscilloscope screen. Display the oscilloscope to the TA.

Now change the function calls so that the resulting square wave keeps the same frequency, but has a 25% duty cycle. Use the oscilloscope to verify that. Display the oscilloscope to the TA.

Connect a function generator output to the second channel of the oscilloscope. Adjust the function generator control knobs to adjust the frequency and the DC bias so that the waveform is a 200 Hz, 0 to 5 V square wave. Use the oscilloscope to show both channels simultaneously. Display the oscilloscope to the TA. Submit your final code to the Pilot drop box.

Lastly, modify the blink code to use register manipulation instead of `digitalWrite()`. Replace the `digitalWrite()` function calls with modifying the registers directly to control the pin. You should leave the `delay()` functions as is from the previous steps. Next, use the `digitalRead()` function to read when a push button is pressed. When the button is held down, the LED should be on with the 25% duty cycle, and the output should appear on the oscilloscope. When the button is not held down, the output on the pin should be shut off. Demonstrate the push button functionality to the TA using the oscilloscope and LED.

### How to Submit

Demonstrate the various milestones mentioned above to the TA in person. Submit the final modified code in the equipment familiarization step to the Pilot drop box. Submit the final modified code in the simulator familiarization step to the Pilot dropbox and send the simulator link to the TA if not demonstrated in the lab.

### Grading

This lab is worth 7.5 points, distributed as follows:

Task	Points
Displayed frequency and duty cycle on oscilloscope ( <code>delay(2)</code> )	1.875
Displayed frequency and duty cycle on oscilloscope (25% duty cycle)	1.875
Displayed both channels on oscilloscope	1.875
Displayed push button and register manipulation	1.875
Total	7.5