

# ECE 5780/6780 Lab 2 – Spring 2024

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Due Date: Wednesday, January 31 (20 points)

## Objectives

The purpose of this lab is to learn how to generate audio output via a DAC and an audio amplifier using FreeRTOS, Keil  $\mu$ Vision, and the STM32L476 Nucleo-64 Board.

## Overview

In this lab you will create, download, execute, and debug a multi-task C program with an interrupt handler that controls the audio output on a speaker using the STM32L476 Nucleo-64 Board.

## Preparation

You will need your STM32L476 Nucleo-64 Board and ECE 5780/6780 lab kit.

## Requirements

1. Make a copy of your Keil  $\mu$ Vision project from Lab 1 to use as a starting point.
2. Refer to the datasheet for the LM386 Audio Power Amplifier. Design a circuit using the components included in your lab kit that will allow a sine wave produced by the STM32L476's DAC be output on the speaker.
3. The user push-button, in addition to toggling the LED (from Lab 1), will now also turn on and off a 440 Hz sine wave audio tone. When the LED is on, the tone should play.
4. As the ARM System Timer (SysTick) is already used by FreeRTOS, use one of the STM32L476's General Purpose Timers (e.g. TIM4) to control the generation of the sine wave.
5. The sine wave is implemented as a software lookup table with 64 entries per a period. A new value from the table is fed to the DAC on each timer interrupt. This website may be useful:

<https://www.daycounter.com/Calculators/Sine-Generator-Calculator.phtml>

**Pass-off**

Demonstrate the working system to the instructor, either in-person, via Zoom, or via a recorded video (emailed to the instructor). Include an oscilloscope screen capture of the 440 Hz sine wave. Make sure the wave isn't clipped.