## Course Information

| | | | |
|---|---|---|---|
| Credits | 1 | Instructors: | Michael E. Huster, Ph.D. and Daniel Cross, Ph.D. |
| Location: | Physics Lab | Office: | TBD |
| Times: | Tue. 1:00 – 4:00 PM | Office hours: | Mon. 3:00 – 5:30 PM |
| Prerequisite: | TBD | | |

## Required Materials

- A laptop on which you can install programs.
- The Kindle book *Get Started with MicroPython on Raspberry Pi Pico 2nd Edition*. Cost $3.99. Go to `https://www.amazon.com/Get-started-MicroPython-Raspberry-Pico-ebook/dp/B0CW1DRBTV/`, click on the *Kindle* link. *Note*: The print edition is not available in the USA until Sep. 3rd, 2024.
- The Kindle app on your laptop.
- A USB micro cable for your laptop. This is the version before USB-C came out.

## Course Description

This course covers how scientific instrumentation is done with modern microcontrollers, successors to the Arduino, can be used to cheaply and easily build and run lab experiments. They are programmed in high-level languages like micropython or C++, so the learning curve is much easier than low-level microprocessor programming.

You will learn how to build devices that do some experiments with very little external circuitry, then work on experiments that use external sensor and control boards. The microcontroller can control an experiment, read the results, and even do analysis like average data, fit data to curves, and display the frequency spectrum of data. Our favorite microcontroller, The Raspberry Pi Pico W (aka PicoW) costs $6 and has WiFi, so you can post data directly to the Internet.

But there is more! There are hundreds of sensor and control breakout boards that extend what these microcontrollers can do. You will see how the experiments you can do are almost unlimited.

This is a one credit laboratory course that meets twice a week for 90 minutes.

## Grading

| Item | # of Items | Points/Item | Points | Percentage |
|---|---|---|---|---|
| Weekly Lab Notebook Entries | 11 | 10 | 110 | 44 |
| Project Presentation | 5 | 20 | 100 | 40 |
| Final Project | 1 | 40 | 40 | 16 |
| Total | | | 250 | 100 |

## Tentative Schedule

Note: The labs actually done may differ from this list due to equipment malfunction, new labs being added to the curriculum, or other contingencies.

| Date | Topic | Lab |
|---|---|---|
| 8/27 | 1 - Introduction to the Pico W | Getting Started, ch 1 & 2<br>Install Thonny programming environment on your laptop. Load latest version of micropython (aka uPy) in the Pico W. Write a blink LED program. |
| 9/3 | 2 – Programming the Pico W | |
| 9/10 | 3- PicoW Interfaces | |
| 9/17 | 4 – a | |
| 9/24 | 5 – a | |
| 10/1 | 6 – a | |
| 10/8 | 7 – a | |
| 10/15 | 8 – a | |
| 10/22 | 9 – a | |
| 10/29 | 10 – a | |
| 11/5 | 11 – a | |
| 11/12 | 12 – a | |
| 11/19 | 13 – a | |
| 12/3 | 14 – a | |
| Final | | |