Engineering: Electronics and Computer Programming

Dr. Bardoe

Instructor Information

Instructor: Dr. Matthew Bardoe
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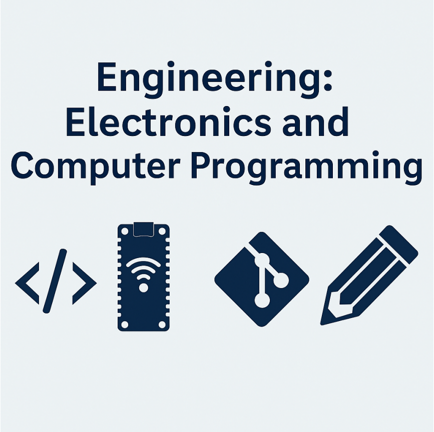
Course Overview

This course introduces students to the fundamentals of electronics, programming, and computational design through hands-on experimentation with the Raspberry Pi Pico W microcontroller and MicroPython. Students will learn to write and test code that interacts with real-world sensors, actuators, and circuits, and will use Git and GitHub to document their work. They will apply the engineering design process to prototype, test, and refine systems that combine hardware and software.



By the End of the Course, Students Will:

- Understand fundamental electrical concepts including **voltage, current, and resistance**.
- Write and debug programs in **MicroPython** using **Thonny**.
- Apply **loops, conditionals, and functions** to control circuits and devices.
- Use **Git and GitHub** to document and manage code versions.
- Design and build circuits using components such as LEDs, buttons, servos, and sensors.
- Apply the **engineering design process** to prototype and refine working systems.

Materials & Resources

- Raspberry Pi Pico W (provided)
- Breadboard, jumper wires, resistors, LEDs, and other electronic components
- Laptop with **Thonny** installed and GitHub account created
- Access to the Maker Space for fabrication as needed
- Course materials provided digitally via Veracross or GitHub Classroom

Units of Study (12 Weeks / ~30 Class Meetings)

Unit	Focus	Approx. Weeks
1	Introduction to Python, Git, and Electricity	1–2
2	Programming Inputs and Outputs	3–4
3	Motors, Power, and Control	5–6
4	Mini Design Project: Interactive Device	7–8
5	Networking and Wi-Fi with the Pico W	9–10
6	Final Project: Smart System Design	11–12

Skills You Will Need

- Willingness to experiment and make mistakes
- Commitment to debugging and improving your code
- Respectful collaboration and communication with teammates
- Organization and time management for multi-day builds

Skills You Will Learn

- Circuit design and breadboarding fundamentals
- Programming with variables, loops, logic, and functions
- Using Git and GitHub for version control and documentation
- Integrating sensors and actuators into functional systems
- Applying iterative design and revision in engineering projects

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Grading and Assessments

Grades will be based on:

Category	Weight	Description
Labs and Checkpoints	25%	Small in-class builds and experiments
Design Projects	40%	Includes mini-project and final capstone
Coding Quizzes	20%	Short in-class quizzes requiring students to write and explain code without assistance
Participation and Collaboration	15%	Engagement, teamwork, and use of GitHub for documentation

Coding Quizzes

Throughout the term, students will take several short **coding quizzes** to demonstrate mastery of programming skills. During these quizzes, students will write code independently (without AI tools) to solve a defined problem using MicroPython. Quizzes will ensure each student can confidently produce and explain code related to course content.

Course Expectations

- **Be Safe:** Follow all Maker Space and electronics safety procedures.
- **Be Respectful:** Support your peers, handle tools and components responsibly.
- **Be Curious:** Experiment, test, and iterate to find creative solutions.
- **Be Responsible:** Keep up with your commits, deadlines, and documentation.

Late Work & Academic Integrity

- Late work will be accepted within reason, but repeated lateness will affect grades.
- All code and design work must be your own. Collaboration must be cited in reflections.
- Submitting AI-generated code you do not understand violates the course AI policy.

AI Tools Policy

AI tools such as ChatGPT or GitHub Copilot may be used **for learning and debugging** but not for completing graded work.
Students must document any AI assistance in their project README files.
All code submitted for quizzes and projects must be fully understood and explainable by the student.

Questions?

Dr. Bardoe is available before or after school by appointment.
Students are encouraged to reach out via email or Teams for clarification or extra help.