



Electronics Engineering & Robotics II

2026-27 School year

Instructor: Michael Wolverton
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Location: Computer Science, Engineering & Robotics Lab
Web Page: <https://cec-code-lab.aps.edu>
Times: CEC Session IIIA Mon. / Wed. 2:50–4:50pm

Prerequisite

Students must have taken Electronics Engineering & Robotics I at the Career Enrichment Center in order to register for Electronics Engineering & Robotics II.

Course Description

Students have the opportunity to continue development of practical electrical engineering skills and knowledge that they began in Robotics I. By practicing electronics and embedded system design in instructor guided project development, students will learn new methods to refine the types of embedded control systems introduced in Robotics I. Students will also learn about new, more complex control systems such as single board computers. Projects will be biased toward sub-components of larger devices that will interface together and may include contributions to large mobile robots, stationary mechatronics or advanced remote control systems.

Course topics of interest include:

Robotics 1 Review

- Electronics Fundamentals
- C Programming Fundamentals
- Component Review
 - H-Bridge Motor Driver
 - IR Proximity
 - Ultrasonic Range Finder

Control Systems Techniques

- Microcontroller Programming Techniques
 - Interrupt Driven Flow Control
 - Timer and Alarm Interrupts
 - Basic Multicore Processing
 - I²C Serial Communication
 - One-Wire serial communication
 - Analog to Digital Conversion (ADC)
 - ADC Threshold Interrupts
- Embedded Linux Single Board Computers
 - Remote Administration by Secure Shell
 - GPIO operation
 - Serial communication to Microcontrollers
 - Web Server Interfaces (Internet of Things)

Sensors & Components

- Stepper Motors
- Voice coils (speakers / microphones)
- Addressable Tricolor LEDs
- Small displays (LCD, OLED, LED Character)
- Photosensors
- Temperature (onboard, thermocouple)
- Inertial Motion (Gyro, Accelerometer)
- Force & Weight (Load Cell)
- Encoders (Pulse, Potentiometer)
- Range Finder (LIDAR and Ultrasonic)
- Battery Monitoring

Introduction to Automation Mechanical Systems & Common Manufacturing for Prototyping

- Basic CAD for parts design
- 3D Printing
- Laser cutting
- Milling & CNC Milling
- Turning (Lathe)
- Materials Selection
- Hand Power Tools
- Rough Processing support tools (saws, drills etc.)

Course Format

Robotics II will feature project based learning supplemented by technical lectures and discussions. A significant portion of the material will be presented by live hands on demonstrations, live coding demonstrations, and students are expected to actively contribute to all projects. This means **regular attendance** is *extremely important*, and that students need to maintain focus and be productive and when in class.

Fees, Learning Resources & Technology Requirements

An online circuit simulator, free open source software, reference documents, course information, assignment details and instructional videos will be at the course web page located at the web address below.

<https://cec-code-lab.aps.edu>

This course currently does not use a dedicated textbooks. Any excerpts or text references will be provided at the course web page. Technical documentation such as product data sheets and other engineering reference documents will play a prominent roll in curricular support.

Assignments & Grading Policy

Assignments

Graded items will typically fall into one of the below categories.

- Review Exercises – Robotics 1 review exercises small written exercises intended as a warm-up. Typically these will be used at the beginning of class to help focus the session. Answers and brief discussion will be provided in class. These will be posted online along with review reference material.
- Demonstration Projects – Demonstration projects will serve as models for larger devices. The intent is to showcase a programming technique and / or determine the operating characteristics of a new device in isolation before incorporating it in a bigger system. Observed characteristics may include sensor sensitivity, motor performance, range of motion, reaction time etc.
- Large Project Contribution – Project activities will involve design, construction, wiring, programming or testing of robot sub-components or control systems. This portion of the grade will be based on participation and effort.
- Project Documentation – As projects progress it is important to document both successful and unsuccessful approaches. This will vary based on the task but may include summary documents, source code comments and formatting, circuit wiring diagrams, mechanical drawings or CAD files.
- Semester Summary – A set of notes each student will write to help them summarize work and learning over the semester. This will take the place of a final exam. It will comprise 10% of each semester grade.

Code and Written Work Plagiarism

Submission of copied code, copied data without experimentation, or copied written work for credit will not be tolerated.

Assignments determined to contain plagiarized work will receive zero credit.

Students that submit plagiarized work may receive an overall failing grade and be referred to CEC administration.

The intent for code projects and assignments is to learn to program by writing code. Similarly, circuit labs are not meaningful without the hands-on element of actually constructing the circuit. Small blocks of code copied from our class reference materials or from previously completed assignments are acceptable, but students must write the vast majority of their code for credit. Similarly, discussion, comparison and group work and discussion in circuit labs is perfectly acceptable, while copying measurements and observations for a project which a student did not participate in is considered plagiarism.

Engineering Challenges & Competitions

There may be one or more relevant engineering challenges or contests based on building and programming electronics or mechatronics systems during the school year. Participation is optional, and the progress toward these objectives is valid for use as a project assignment when relevant. Challenge project participation does not excuse general participation in whole class lessons or labs, however.

CEC Cell Phone Policy

To create an optimal learning environment, cell phone use is to be limited to educational and medical purposes only. Teachers do have discretion to have students use cell phones for educational purposes. Students who need to use their cell phone for medical purposes must have documentation in Synergy.

Teacher Discretion

Teachers have the authority to establish specific cell phone rules in their classrooms. These rules must be communicated clearly to students in the course syllabus at the beginning of the term and must align with the overall school policy. Teachers will clearly communicate to students when the use of cell phones is allowed for educational purposes. Students who need to use their cell phone for medical purposes must have documentation in Synergy.

Consequences (per class)

1. First Offense: Verbal warning by teacher and confiscation of the cell phone for the remainder of the class. The Student will be reminded of classroom policy when they retrieve their phone.
2. Second Offense: Confiscation of the cell phone for the remainder of the Session, and the teacher will contact parent/guardian by phone or email that same day, and log contact in Synergy. Teacher will contact the front desk and a staff member will come to the classroom to retrieve, log and secure the confiscated phone until the end of the Session. The student will retrieve their phone from the front desk at the end of the Session.
3. Third Offense: Confiscation of the cell phone by front office staff, administrator contact with parent, and the parent must pick up the cell phone from school personnel.
4. Fourth Offense or Repeat Offenses in Multiple Classrooms: Administrator conference with parent/guardian and student. Student will not be allowed to bring a cell phone to the CEC Campus for the remainder of the school year. Violation will result in disciplinary action.

Emergency Use

Parents/guardians needing to contact students during school hours should do so through the front office (505-247-3658 ext. 45400).

College Credit

In partnership with the University of New Mexico Electrical and Computer Engineering department, the Career Enrichment Center will be able to offer a college class credit for UNM ECE 131 Lab: Programming Fundamentals in addition to APS high school elective credit. The dual credit opportunity applies to the spring (second) semester. **Note that dual credit enrollment is not guaranteed for all students.** *Application for dual credit is dependent upon completion of extra assignments as well as good performance in the first semester. Dual credit applications can be rejected by the instructor or the UNM Dual Credit admissions office for a variety of reasons.* Students not approved for dual credit may remain enrolled as APS high school students receiving elective credit, as in the fall semester. Dual credit students will be assigned significantly more work, and graded more rigorously and need to work outside of class on additional assignments. A second syllabus will be issued at the start of second semester describing relevant changes in grading and classroom policy. Students can also enroll for UNM ECE 131 dual credit in Robotics 2 the following year if they choose to continue at CEC. This is generally a better option when available because it affords the student more time and support.