Open Project Space

Program Syllabus

Fall 2024 - Spring 2025

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Course Description

Open Project Space (OPS) is a year-long technical course in embedded systems. We introduce engineering students to topics relevant to their coursework and potential career paths: integrated circuits, breadboarding, soldering, microcontrollers, embedded programming with C++, hardware communication, and PCB design.

Unlike a traditional college course, we aim to increase engagement with project-based learning. Students individually complete eight projects encapsulating the program's topics, culminating in one final capstone project where they design and build a remote-controlled rover. Regularly scheduled workshops and lectures complement the projects.

Enrollment Requirements

Undergraduate students attending the University of California, Irvine, can apply for course enrollment. The deadline for application submissions is **October 4th, 2024** at **11:59PM**. Submitting an application does not guarantee acceptance to the program. Students who receive a course acceptance offer must pay the course deposit and fee before enrollment.

Course Deposit + Fee

You will pay **$120** ($60 refundable deposit + $60 course fee) at the beginning of the program. In exchange, you will receive a parts kit that you keep with the components needed to complete the course projects. Project deadlines are due the quarter they are assigned, and you will be refunded $20 upon completing each quarter's required projects. By the end of the year, you can earn the full $60 deposit back.

Parts Kit Component List

- 9V Snap Connector (x1)
- ESP32 (USB-C) (x2)
- USB- A to USB-C Cable (x1)
- Ball Caster (x1)
- Ball Caster Chassis Grip (x1)
- Battery, 9V (x2)
- Battery Holder, 3D-Printed (x1)
- Breadboard, 400 Points (x2)
- Piezo Buzzer 1.5V (x2)
- Capacitor, Ceramic, 0.1uF, 50V (x2)
- Capacitor, Ceramic, 10uF, 25V (x2)
- Capacitor, Ceramic, 1uF, 50V (x2)
- Custom PCB, 100x100mm (x1)
- AHT20 Temp+Hum Sensor (x1)
- Digital Multimeter (x1)
- DIP8 Socket (x1)
- Female-Male Jumper, Dupont, 20cm (x20)
- Gearbox Motor (x2)
- Header, 2.54mm, Female, 1x12 (x2)
- Header, 2.54mm, Female, 1x2 (x2)
- Header, 2.54mm, Female, 2x4 (x1)
- Header, 2.54mm, Female, Right Angle, 1x5 (x1)
- Joystick (x1)
- Jumper Cable Kit, 140 Pcs (x1)
- L293D (x1)
- LCD, 16x2 + I^2C Backpack (x1)
- Assorted LEDs, 2V (x9)
- LED, RGB, 5mm, Common Cathode (x1)
- Micro SD, 1GB (x1)
- Micro SD Adapter (x1)
- Mini MP3 DF Player Module (x1)
- NE555P (x2)
- NRF24L01+ Transceiver (x2)
- Perfboard (x1)
- Photoresistor (x1)
- Potentiometer (x3)
- 555 Piano PCB (x1)
- Resistor, 220Ω, 5%, 1/4W (x5)
- Resistor, 390Ω, 5%, 1/4W (x5)
- Resistor, 1KΩ, 5%, 1/4W (x5)
- Resistor, 4.7KΩ, 5%, 1/4W (x5)
- Resistor, 10KΩ, 5%, 1/4W (x5)
- Resistor, 470KΩ, 5%, 1/4W (x5)
- Slotted Screwdriver (x1)
- Tactile Switch (x5)
- Slide Switch (x2)
- Speaker, 1/2W (x1)
- Storage Box (x1)
- Micro Servo (5V) (x1)
- TM1637, 7 Segment Display (x1)
- T-Shirt (x1)
- Wheels (x2)
- Wood Plate, 4"x4" (x1)

Projects

With exception to the Spring Quarter, projects are usually assigned every two weeks. These projects are typically due two weeks from their start date, while small assignments are due one week from their start date.

All the required projects must be completed before the final course deadline (TBD) for a student to be eligible for their deposit reimbursement.

Listed below are the projects assigned each academic quarter:

Fall Quarter

Project	Topics	Description
LED there be Light (Week 3)	Circuits, Voltage, Current, Resistance, Ohm's Law, Breadboarding, Soldering	Build an LED circuit with a switch and solder it to a perfboard.
555 Piano (Week 5)	Circuit Analysis, Nodes, Multimeters, Circuit Troubleshooting, Integrated Circuits, 555 Timer	Create an electronic piano with the 555 Timer IC, and solder it to a printed circuit board.
RGB LED Wizard (Week 7)	Microcontrollers, ESP32, Arduino IDE, Pulse Width Modulation	Build and program a dimmable RGB LED using the ESP32 and potentiometers.
Sun Dial (Week 9)	Microcontrollers (continued), ESP32, Arduino Libraries	Build a sundial that measures the brightness of your room with a micro servo.

Winter Quarter

Project	Topics	Description
iPoduino v.3.0 (Week 1)	Basic Computer Architecture, Arduino	Build and program a music player with

	Libraries, Pulse Width Modulation, UART Protocol	ESP32, customized to play your own tunes.
Weather Station (Week 3)	Communication, I^2C Protocol, SPI Protocol	Build a weather station that wirelessly transmits temperature and humidity data to an indoor display.
Digital Stopwatch (Week 5)	Interrupts, Timers	Create a digital stopwatch using interrupts, timers, and a 7-segment display.
Capstone PCB Design (Week 7) (Optional)	KiCAD, Schematics, PCB Design, PCB Manufacturing	Design a remote control PCB that you will use to control the Capstone RC Rover during Spring Quarter.

Spring Quarter

Project	Topics	Description
RC Rover	Everything	Build and control a rover remotely with a custom PCB.

Lectures

Lectures are hosted live every two weeks or pre-recorded unless otherwise stated. The exact dates, times, and locations are tentative. Each lecture discusses the topics relevant to upcoming projects and introduces the next project.

Listed below are the lectures hosted each academic quarter (Dates/content are subject to change):

Fall Quarter

Title	Date
OPS Year-Long Roadmap & Introduction to Circuits	Week 3
Integrated Circuits & Debugging Equipment and Techniques	Week 5
Microcontrollers & Introduction to ESP32	Week 7
C/C++ Programming Review	Week 9

Winter Quarter

Title	Date
Communication Protocols I	Week 1
Communication Protocols II	Week 3
Interrupts and Timers	Week 5
PCB Design Concepts	Week 7

Spring Quarter

Title	Date
RC Rover: Getting Started	Week 1
Other Microcontrollers	Week 3
Professional Development	Week 5

End of the Year Review/Reflection	Week 7

Workshops

Workshops are hosted live or pre-recorded each quarter to supplement the projects. The exact dates, times, and locations are TBD. Each workshop serves as an interactive tutorial.

Listed below are the workshops assigned each academic quarter (Dates/content are subject to change):

Fall Quarter

Title	Date
Breadboarding, Soldering	Week 4
Soldering	Week 6
Arduino IDE Setup & Potentiometers	Week 8
LinkedIn Workshop	Week 10

Winter Quarter

Title	Date
ESP32 Wifi Set-up	Week 2
Finite State Machines (Recorded)	Week 4
PCB Design with KiCad	Week 7
Resume Workshop	Week 10

Spring Quarter

Title	Date
Capstone Rover Assembly	Week 2

Capstone PCB Assembly	Week 4
Capstone Programming	Week 6

Agreement

By signing this document, you agree to the statement below:

I hereby agree to pay the required sixty-dollar deposit and sixty-dollar course fee in exchange for the project materials and access to OPS lectures and workshops. I accept that a full reimbursement of the deposit is contingent on my completion of each project by the course's final deadline. I understand that I am eligible to refund my project kit only until the end of fall quarter if I choose not to continue with the program.

I understand that inappropriate behavior or any other form of misconduct inconsistent with the club constitution or bylaws may result in my removal from the OPS program without reimbursement of the deposit.

Participant's Full Name (*Print*): _____

Participant's Signature: _____ / Date: _____

Liability Release

On this day of _____ intending to be legally bound hereby, the undersigned agrees and does hereby release from liability and to indemnify and hold harmless the Institute of Electrical and Electronics Engineers at the University of California, Irvine, and any of its officers as regards to the Open Project Space program and related workshop events. This release is for any and all liability for personal injuries, attorney fees and property losses or damage occasioned by, or in connection with any activity or accommodations for this program. The undersigned further agrees to abide by all the rules and policies promulgated by the Institute of Electrical and Electronics Engineers at the University of California, Irvine and/or its affiliate groups and vendors throughout the program.

Participant's Full Name (*Print*): _____

Participant's Signature: _____ / Date: _____

If the participant is under 18 years of age, a parent or guardian must sign below:

Parent's Full Name (*Print*): _____

Parent's Signature: _____ / Date: _____