POINT 1902 LOMA
NAZARENE UNIVERSITY

Department of Physics and Engineering

EGR 4043/L Embedded Systems and Robotics

3 Units

Spring 2025

Meeting days/times: R 10:00 – 11:45 AM, 1:30 – 4:20 PM (Lab)

Meeting location: Rohr Science (RS) 365

Final Exam: Thursday, 05/08, 10:30 AM – 1:00 PM

INFORMATION	SPECIFICS FOR THE COURSE
Instructor title and name:	Dr. José Manjarrés
Phone:	619-849-2451
Email:	josemanjarres@pointloma.edu
Office location and hours:	RS276, MWF 9 AM – 12 PM, 3:00 PM – 4:00 PM / T 1:00 pm – 2:00 PM

PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Course Description

Embedded systems are everywhere. They are in your watch, your phone, and your TV. Embedded systems are also found in cars, airplanes, and robots. They are a fundamental part of the "internet of things." In this hands-on course you will learn the basics of designing, interfacing, configuring, and programming embedded systems by working with robots.
Letter grade.

Prerequisite(s): CSC 2054 with a grade of C- or higher or EGR 2024 with a grade of C- or higher.
Corequisite(s): EGR 4043L

Program and Course Learning Outcomes

Course Learning Outcomes:

- Build a basic robotic arm
- Develop programs following best practices for embedded software
- Analyze a robotic arm design using forward and inverse kinematics
- Implement hardware and software timers
- Design and implement autonomous routines for a mobile robot

Program Outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (LO1)
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (LO2)

Required Texts and Recommended Study Resources

Students are responsible for having the required course textbooks prior to the first day of class.

All supplemental materials posted on this course site (including articles, book excerpts, or other documents) are provided for your personal academic use. These materials may be protected by copyright law and should not be duplicated or distributed without permission of the copyright owner.

1. ESP32 Tutorials from esp32io.com
2. ESP32-WROOM-32 Datasheet

Course Credit Hour Information⍟

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a 3-unit class delivered over 15 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend an estimated 112.5 total hours meeting the course learning outcomes.

Assessment and Grading

This course will have three ways to assess knowledge and learning, described as follows.

1. Checkpoints: Short tasks developed during lab time. They are milestones necessary for each of the class projects. Checkpoints are graded at the end of each class session based on completeness and technical accuracy of the student's explanation.

2. Projects: Robot-building projects that span several weeks and culminate in a presentation where the robots complete a series of tasks. The grade is based on the robot's performance at each task.
3. Competitions: Following each project presentation, all class robots will compete against each other in a series of tasks similar to those of the project. Competition results are only for additional credit in checkpoint grades and do not impact negatively student grades.

The table below outlines the assessment criteria for this course.

Activity	Points Per Activity	Quantity	Total Points
Checkpoints	50	9	450
Projects	150	3	450
Competitions	100	3	NA
Total			**900**

Grades will be based on the following:

Sample Standard Grade Scale Based on Percentages

A	B	C	D	F
A [92.5-100]	B+ [87.5-90)	C+ [77.5-80)	D+ [67.5-70)	F [0-60)
A- [90-92.5)	B [82.5-87.5)	C [72.5-77.5)	D [62.5-67.5)	
	B- [80-82.5)	C- [70-72.5)	D- [60-62.5)	

Final Examination Policy

Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the Traditional Undergraduate Records: Final Exam Schedules site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

Incompletes and Late Assignments

All assignments are to be submitted/turned in by the beginning of the class session when they are due—including assignments posted in Canvas. Late assignments are deducted 20% of its grade. Incompletes will only be assigned in extremely unusual circumstances.

Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g., ChatGPT, Gemini Pro 1.5, GrammarlyGo, Perplexity, etc) to generate ideas, but you are not allowed to use AI tools to generate content (code, text, video, audio, images) that will end up in any work submitted to be graded for this course; if you do so, it'll be considered a case of academic dishonesty and prompt disciplinary action. If you have any doubts about using AI, please gain permission from the instructor.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2486). Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines allowed accommodations. The EAC makes accommodations available to professors at the student's request.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course. Accommodations are not retroactive so clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC. Students cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any special accommodations.

Additional Course Information:

Additional PLNU policies and practices that apply to this course can be found at the following link: https://docs.google.com/document/d/18i1pUoY0iCfB8w7JKxVvACQW309X-JRB/edit?usp=sharing&ouid=116164865489739533893&rtpof=true&sd=true

Tentative Teaching Schedule:

Date	Topic
16-Jan	Welcome/Introduction to Embedded Systems/GPIO
23-Jan	Embedded Software Design
30-Jan	Introduction to Robotic Arms
6-Feb	I2C
13-Feb	Robot Arm Time
20-Feb	Competition 1
27-Feb	Interrupts
6-Mar	ADC
13-Mar	Spring Break
20-Mar	Timers
27-Mar	Competition 2
3-Apr	Autonomous Routines
10-Apr	Braitenberg Vehicles
17-Apr	Easter Break
24-Apr	Distance Sensing
1-May	Final Project Time
8-May	Final Project Presentations