

# **Embedded Controller Programming with Embedded C Syllabus**



**Course Number: ECE-40291**

**Quarter: Fall, Winter, Spring, Summer**

**Credit: 3-Units**

## **Instructor Information**

Name: Norman McEntire

Email: [norman.mcentire@gmail.com](mailto:norman.mcentire@gmail.com)

## **Communication Policy**

You may contact me via email function at any time. I will respond typically within 24 hours, and no longer than 48 hours.

Often the best and fastest way to get questions answered is by posting them on the Blackboard discussion area. By posting your question on the Blackboard discussion area, both the instructor and other students can help to answer and discuss the question.

## Course Information

### Course Description (Goals and Objectives)

The goal of this course is to prepare students to program embedded controllers using embedded C. The course begins with a study of the embedded C programming language, focusing on the features of embedded C that make it different from standard C. The student will learn how embedded C data structures, functions, and macros are used at various levels, including: LL (lower-layer), HAL (Hardware Abstraction Layer), and BSP (Board Support Package) layer. Upon completion of the course, students will be able to:

- Differential between embedded C and standard C
- Use embedded C data structures, functions, and macros
- Learn how to use the LL (lower layer) embedded C functions
- Learn how to use the HAL (Hardware Abstraction Layer)
- Learn how to use the BSP (Board Support Package)
- Manage GPIO (General Purpose Input/Output) devices
- Manage UART (Universal Async Receiver/Transmitter) devices
- Manage ADC (Analog to Digital Conversion) devices
- Manage I2C (Inter Integrated Circuit) devices
- Manage SPI (Serial Peripheral Interface) devices

The above topics will be covered using a combination of presentation, demonstration, and coding-focused lab exercises. The lab exercises will use various tools to build, run, and debug code on the STM32 Discovery Kit IoT Node.

Upon completion of the course, students will have gained a solid working knowledge of Embedded Controller Programming with Embedded C. Students will also gain insight into how to use their new embedded C skills to solve problems in their specific industry.

### **Course Prerequisites:**

You should have already completed ECE-40292 Embedded Systems Hardware Design or equivalent knowledge.

### **Hardware:**

The STM32 IOT Discovery Node 915 MHz - Mfg. Part # B-L475E-IOT01A will be used throughout this course. You can purchase this board from Digi-Key or any other reputable electronics dealer. Since this same STM32 IOT Discovery Node is used in all Embedded Courses, you may already have one.

### **Student Learning Outcomes**

By the end of this course, students will be able to:

- Use embedded C Tools and Toolchains
- Use embedded C with the LL (Lower-Level) interface
- Use embedded C with the HAL (Hardware Abstraction Layer)
- Use embedded C with the BSP (Board Support Package)
- Use embedded C to manage UART (Universal Async Receiver/Transmitter) devices
- Use embedded C to manage ADC (Analog to Digital Conversion) devices
- Use embedded C to manage I2C (Inter Integrated Circuit) devices
- Use embedded C to manage SPI (Serial Peripheral Interface) devices

CSE-40291 Embedded Controller Programming with Embedded C  
UC San Diego Extension - Information Technology and Software Engineering

## Course Schedule

Session	Topic	Reading
1	<i>Introduction to Embedded C, STM32CubeIDE</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
2	<i>LL (Lower-Layer) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
3	<i>HAL (Hardware Abstraction Layer) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
4	<i>BSP (Board Support Package) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
5	<i>GPIO (General Purpose Input/Output) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
6	<i>ADC (Analog-to-Digital Conversion) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
7	<i>UART (Universal Async Receiver/Transmitter) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
8	<i>I2C (Inter-Integrated Circuit) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>
9	<i>SPI (Serial Peripheral Interface) and Embedded C</i>	1) <i>Course Slides</i> 2) <i>URLs mentioned in course slides</i>

## Course Materials and Textbooks

There is no textbook for this course. Rather the course slides, videos, and URLs referenced in each lesson provided the needed course materials.

## Grading and Assignment Information

Letter grades are based on the [UC San Diego Extension Grading Scale](#). Your final course grade is based on the percentage of points you have earned.

Passing Grades	
A	100-90
B	89-80
C	79-70

Non-Passing Grades	
D	79-60
F	59 and below

### Weighted Grading Criteria

Quizzes(8): 40 points

Assignments(8): 40 points

Final Assignment: 20 points

---

You can check your point total in Canvas at any time.

## Grading Policies

This course can be taken as part of the Embedded certificate. In order for the class to count towards your certificate it must be taken for a letter grade or as pass/no pass. Classes that are taken as NFC cannot count towards a certificate. You can change your grading option any time BEFORE the last day of class through [My Extension](#).

### Late Policy:

There is not an exact due date for the assignments, although students are encouraged to complete one lesson/assignment per week. There is **no** penalty if work is not submitted on a given week. The only hard deadline is that all lessons and assignments must be completed by the last day of the course.

## Assignments

A total of eight programming assignments will be assigned, one each for modules 1-8 in the course. The programming assignments require writing code and submitting a PDF documenting your steps and the code.

### Quizzes

Online quizzes will be part of the first 8 modules. The quizzes are short and ask key questions to verify your mastery of skills covered in the relevant section.

## UC San Diego Extension Policies and Resources

### Academic Policies and Procedures

Please refer to UC San Diego Extension's website (Student Resources tab) for specific details about academic policies and procedures: [Student Resources](#).

### MyExtension

Your MyExtension account is your student records portal. Log into [MyExtension](#) (<https://myextension.ucsd.edu/>) to enroll in a course, drop a course, request verification of enrollment, request official transcripts and more.

## **Campus Emergencies**

In the event of an emergency, information will be posted at UC San Diego Extension (<http://extension.ucsd.edu/>). Extension students must access the website to find out the status of the emergency situation. Email and or phone lines may not be accessible. Information will be updated online as the situation progresses and an ALL CLEAR will be posted once the situation is resolved.

## **Code of Conduct**

All participants in a course at UC San Diego Extension are bound by the University of California, Code of Conduct found at [Student Conduct Code](#).

## **Academic Integrity Policy**

The University is an institution of learning, research, and scholarship predicated on the existence of an environment of honesty and integrity. As members of the academic community, faculty, students, and administrative officials share responsibility for maintaining this environment. It is essential that all members of the academic community subscribe to the ideal of academic honesty and integrity and accept individual responsibility for their work. Academic dishonesty is unacceptable and will not be tolerated at the University of California. Cheating, forgery, dishonest conduct, plagiarism, and collusion in dishonest activities erode the University's educational, research, and social roles.

If students who knowingly or intentionally conduct or help another student perform dishonest conduct, acts of cheating, or plagiarism will be subject to disciplinary action at the discretion of UC San Diego Extension. Please refer to UC San Diego Extension website to view this policy: [Student Conduct Policy](#).

## **Access and Accommodations**

At UC San Diego Extension, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, we encourage you to contact the Extension Disability Coordinator to apply for reasonable accommodations. Visit our website: [Services for Students with Disabilities](#). Please note that it is your responsibility to initiate contact with the Disability Coordinator.

Phone: 858-822-1366

Email: [unex-ssd@ucsd.edu](mailto:unex-ssd@ucsd.edu)