

San José State University

College of Engineering/Electrical Engineering Department EE 30: Introduction to Programming Microcontroller for Electrical Engineering, Sections 01 (Lecture), 02 and 03 (Labs), Fall 2020

Updated on 8/17/2020
Refer to Canvas for the current version

Course and Contact Information

Lecture Instructor:	Chao-Li Tarng, Ph.D.
Office Location:	ENG 259
Email:	chaoli.tarng@sjsu.edu
Office Hours:	Wednesday 3:00 pm – 4:00 pm
Lab Instructor:	Bhawandeep Singh Harsh
Email:	bhawandeepsingh.harsh@sjsu.edu
Office Hours:	Tuesday and Thursday 7:15 pm – 7:45 pm
Class Days/Time:	Tuesday and Thursday, 12:00 pm – 12:50 pm
Lab Days/Time:	Tuesday, Wednesday 4:30 pm – 7:15 pm
Classroom:	Online
Prerequisites:	MATH 30 or equivalent and ENGR 10 (with grade of "C-" or better)

Course Format

Students taking EE30 are required to register for one lecture section and one laboratory section. Due to the COVID-19 coronavirus pandemic, there are no required in person meetings. Both the lectures and labs are offered online using the Zoom meetings. Students will be provided the microcontroller-based development kit for the lab. For those students who wish to come in person for the labs, computers will be provided in the lab. Students are required to install a suitable C/C++ IDE (integrated development environment) on their own personal machines for practice. Code Composer Studio from Texas Instrument used for the course is also available free from the Texas Instrument website.

This course combines both lectures and lab work.

The lecture section comprises introduction to algorithm development and programming in C/C++ covering topics like user and File I/O, conditional constructs, loops, arrays, user defined data types, storage types and multi-file C/C++ programs. Embedded concepts of programmer's model, special function registers, GPIO programming and a generic (SysTick) timer programming are covered.

The laboratory section includes C/C++ programming on PC and embedded platforms covering lecture topics. The lab uses program development tools for PC and microcontroller-based computer systems. Debugging, testing and documentation, using the C/C++ programming language are covered.

Due to COVID-19 pandemic: Lectures, labs, quizzes, and exams will be conducted online using Zoom and Canvas. Students are required to have a personal computer and install the necessary software such as the Respondus LockDown Browser in order to take the online quizzes and exams. The personal computer must be equipped with a webcam so that students can be proctored during exam using the webcam.

Due to the online nature of the class, the lectures (i.e., Zoom meetings) will be recorded. The recording will be posted for students to review once available. Students must obtain permission in advance to record any course materials. Such permission allows the recordings to be used for a student's private, study purposes only. Students will not be permitted to share any class recordings with someone who isn't enrolled in the class or without permission. The recordings are protected by instructor's copyright.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the course shell available from the eLearning platform [Canvas Learning Management System course login website](http://sjsu.instructure.com) at <http://sjsu.instructure.com>. You are responsible for regularly checking with the messaging system through [MySJSU](http://one.sjsu.edu) on [Spartan App Portal](http://one.sjsu.edu) <http://one.sjsu.edu> (or other communication system as indicated by the instructor) to learn of any updates.

Course Description

Introduction to the C programming language and program development using an integrated development environment. Program development includes program design, development, debugging, testing and documentation. Electrical engineering application examples dealing with circuits, systems, data converters and signal processing concepts are used throughout the course.

Prerequisite: ENGR 10, MATH 30 with a minimum grade of "C-".

Misc/Lab: Lecture 2 hours/lab 3 hours.

https://catalog.sjsu.edu/preview_course_nopop.php?catoid=2&coid=7554

Course Goals

Introduction to programming in C for both PC and embedded platforms and the concepts of microprocessor, microcontroller, programmer's model.

Course Learning Outcomes (CLO)

Course Learning Outcomes are based on the following ABET Student Outcomes.

Upon successful completion of the course, students must be able to:

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

3. acquire and apply new knowledge as needed, using appropriate learning strategies.

Upon successful completion of this course, students will be able to:

1. Develop algorithms for programming problems
2. Program in C/C++ using the different features of C/C++ like loops, pointers, structures etc. as well as different features of software development like breakpoints and watch windows etc. to solve variety of programming problems in Electrical Engineering
3. Understand the difference between microprocessor and microcontroller and between PC and Embedded systems organization and development environments and use them appropriately.
4. Understand the concepts of peripherals, programmer's model and Special Function Registers and employ these concepts to program GPIO and SysTick timer modules in ARM Cortex M4.
5. Use industry standard IDEs for both PC and embedded systems programming (using Microsoft Visual Studio for PC and Texas Instruments Code Composer Studio for Embedded Systems).

Required Texts/Readings

There is no single textbook that covers the basics of C/C++ for both PC and embedded targets. Hence, there is no single course textbook. Students may follow any introductory C books of their liking and/or any of the books on embedded programming from the ones mentioned below. Necessary notes will be provided.

Recommended books for C/C++

- Gary Bronson, *C for Engineers and Scientists, An Introduction to Programming with ANSI C*, Thomson Learning (now Cengage), ISBN-10:0314008160, ISBN-13:9780314008169
 - Amazon: https://www.amazon.com/Engineers-Scientists-Introduction-Programming-ANSI/dp/0314008160/ref=sr_1_2?keywords=gary+bronson+c+for+engineers&qid=1579730177&sr=8-2
- [C++] Juan Soulié, *C++ Language Tutorial*, 2007
 - Free Download: <http://www.cplusplus.com/files/tutorial.pdf>

Recommended books for embedded systems programming with MSP432

- Mazidi, Chen, Naimi, and Salmanzadeh, *TI MSP432 ARM Programming for Embedded Systems*, (Uses Keil IDE)
- Jonathan Valvano, *Real Time Interfacing to the MSP432 Microcontroller*, (Uses TI CCS)

Other Technology Requirements/Equipment/Material

Students will be provided the microcontroller-based development kit for the lab. For students who wish to come in person for the labs, computers will be provided in the lab. Students should install any suitable C/C++ IDE (integrated development environment) on their own personal machines for practice. Code Composer Studio from Texas Instrument used for the course is also available free from the Texas Instrument website.

Course Requirements and Assignments

Each week's lab report will be due at the beginning of the following week's lab. Late lab reports will not be accepted.

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of

45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

Final Examination and Evaluation

There will be one final exam for the lecture section and one final exam for the laboratory section. There will be two midterms for the lecture and one for the laboratory section, respectively. The class is allowed to choose (one decision for both sections) between having either a midterm + final exam or a term project for the Laboratory section.

Lecture midterm and final exam are individual exams.

Laboratory exams may be in groups. In which case, each member of the group will be expected to be able to explain the work and answer relevant questions individually and independently. Consequently, a portion of marks will be for the output of teamwork; while a portion of marks will be for individual performance.

One letter-size cheat-sheet (both sides) is allowed for both midterms and final exams.

No make-up exams will be given.

Your final grade will be assessed based on the following components:

Homework assignments and quizzes	Collaboration allowed for homework*	15%
Labs	Collaboration allowed*	25%
Lecture midterm exam 1	Individual exam	10%
Lecture midterm exam 2	Individual exam	10%
Comprehensive Lab Assessment 1	Individual exam	10%
Lecture final exam	Individual exam	15%
Comprehensive Lab Assessment 2	Individual exam	15%

*Note: Collaboration means discussions only. Assignments and labs must be worked on and submitted independently. Sharing or copying solutions are not allowed and will be considered plagiarism.

The instructors reserve the right to change the percentages.

Grading Information

Grade	Overall Score
A plus	> 95
A	90-95.99
A minus	85-89.99
B plus	80-84.99
B	75-79.99
B minus	70-74.99
C plus	65-69.99
C	60-64.99
C minus	55-59.99
D plus	50-54.99

D	45-49.99
D minus	40-44.99
F	< 40

- **No late assignments will be accepted.** An extension will be granted only if a student has serious and compelling reasons that can be proven by an independent authority (e.g. doctor's note if the student has been sick).
- **The exam dates are final.**

Classroom Protocol

- Students are encouraged to ask questions in the class.
- Each student is required to engage in classroom activities, submit assignments and reports on time, *and* take exams and tests on time.
- Web-browsing and online chatting in class are not allowed. Cell phones are to be turned off during lectures, labs, and tests. During exams if you receive a cell phone call or page it will be assumed that you have completed your exam and no further work will be allowed.
- No make-up exams will be held.
- Exams will be closed-book. One letter size cheat-sheet will be allowed on each exam.
- Students are encouraged to use Canvas for communications. While it is preferred to ask technical doubts in class, for all non-technical questions – like syllabus portion, exam format etc. it is good not to ask in person but over Canvas since that allows the instructors to make a Canvas announcement regarding the subject.
- Student causing disruption in the class will be asked to leave the class

Zoom Classroom Etiquette

- **Mute Your Microphone:** To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- **Be Mindful of Background Noise and Distractions:** Find a quiet place to “attend” class, to the greatest extent possible.
 - Avoid video setups where people may be walking behind you, people talking/making noise, etc.
 - Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- **Position Your Camera Properly:** Be sure your webcam is in a stable position and focused at eye level.
- **Limit Your Distractions/Avoid Multitasking:** You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- **Use Appropriate Virtual Backgrounds:** If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

University Policies

Per [University Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9.pdf) (<http://www.sjsu.edu/senate/docs/S16-9.pdf>), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](#) at <http://www.sjsu.edu/gup/syllabusinfo/>. **Make sure to visit this page, review and be familiar with these university policies and resources.**

EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor.”

Measures Dealing with Occurrences of Cheating

- Department policy mandates that the student or students involved in cheating will receive an “F” on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.
- A student’s second offense in any course will result in a Department recommendation of suspension from the University.

EE30, Introduction to Programming Microcontroller for Electrical Engineering Fall 2020 Course Schedule

The schedule is subject to change with one week notice.

Course Schedule

Week	Date	Work	Topics	Readings/ Lab information
1	Thurs Aug 20	Lecture	Introduction to EE30. Introduction to C/C++. Programming concepts, Why C for Electrical Engineering, C/C++ syntax	Ch. 1
	Wed Aug 19	Lab	No labs. Labs begin the following Tuesday	
2	Tues, Thurs Aug 25, 27	Lecture	Number systems in programming, C/C++ user I/O (input/output)	Ch. 1
	Tues, Wed Aug 25, 26	Lab	Lab 1 - Introduction to C and Visual Studio	
3	Tues, Thurs Sep 1, 3	Lecture	Data types, keywords and arithmetic operations	Ch. 2
	Tues, Wed Sep 1, 2	Lab	Lab 2 - Data types, I/O and operators	Deadline for class decision b/w term project or midterm and final exams for lab section
4	Tues, Thurs Sep 8, 10	Lecture	Bit Operations - and, or, complement, shift	Ch. 13
	Tues, Wed Sep 8, 9	Lab	Lab 3 - bitwise operators and low level programming	
5	Tues, Thurs Sep 15, 17	Lecture	Selection (conditional) - relational expressions, if-else, switch	Ch. 4
	Tues, Wed Sep 15, 16	Lab	Lab 4 - conditional constructs	If project chosen, deadline to submit teams and project topic
6	Tues, Thurs Sep 22, 24	Lecture	Repetition (loops) - while, do-while, for, nesting of loops Lecture midterm 1 (Sep 24, Thurs)	Ch. 5

	Tues, Wed Sep 22, 23	Lab	Lab 5 - Looping constructs	
7	Tues, Thurs Sep 29, Oct 1	Lecture	Functions, introduction to the concept of scope, lifetime, visibility, passing by and returning a value or reference	Ch. 7
	Tues, Wed Sep 29, 30	Lab	Lab 6 - Functions and recursion	
8	Tues, Thurs Oct 6, 8	Lecture	Arrays, sorting	Ch. 6
	Tues, Wed Oct 6, 7	Lab	Lab 7 - Arrays, functions and sorting	
9	Tues, Thurs Oct 13, 15	Lecture	Data files - create, open, read, write, text and binary files	Ch. 8
	Tues, Wed Oct 13, 14	Lab	Lab repetition and practice	Only if class chooses exams, otherwise (if project is chosen) Lab 8 will be done so more portion is covered sooner helping class in doing the project.
10	Tues, Thurs Oct 20, 22	Lecture	Struct, union, enum, typedef	Ch. 12, Ch. 14.2
	Tues, Wed Oct 20, 21	Lab	Lab mid-term	
11	Tues, Thurs Oct 27, 29	Lecture	Pointers, memory management Lecture midterm 2 (Oct 29, Thurs)	Ch. 10
	Tues, Wed Oct 27, 28	Lab	Lab 8 - File I/O	
12	Tues, Thurs Nov 3, 5	Lecture	Pointers, memory management	Ch. 10
	Tues, Wed Nov 3, 4	Lab	Lab 9 - Character strings and structures	
13	Tues, Thurs Nov 10, 12	Lecture	Character strings	Ch. 11
	Tues Nov 10, Wed 11 - Campus closed	Lab	Introduction to Code Composer Studio - TI Module 1 of RSLK learning course - up to 1.4.6	Wed Nov 11, is campus closed

14	Tues, Thurs Nov 17, 19	Lecture	Introduction to embedded systems, microcontroller vs microprocessor, real-time device drivers, TI MPS432 LaunchPad, ARM Cortex M4, address spaces, timers, peripherals, GPIO.	Notes
	Tues, Wed Nov 17, 18	Lab	MSP432 GPIO programming in C - TI Module 1 of RSLK learning - from 1.4.7 to the end	
15	Tues, Thurs Nov 24, 26	Lecture	<i>Thanksgiving Holiday - no class</i>	
	Tues, Nov 24, Wed 25 - No Instruction	Lab	<i>Repetition</i>	Wed Nov 25 is No Instruction.
16	Tues, Thurs Dec 1, 3	Lecture	Embedded C/C++, why C/C++ for embedded? C data types, concept of CPU, memory, I/O, interrupts, delays	Notes
	Tues, Wed Dec 1, 2	Lab	Lab Final Exam	
	Thur Dec 10	Final Exam	<u>Final Exam: Thursday 12/10/2020, 9:45am - 12:00pm</u>	