Course Syllabus

CE 351 Microcontrollers (3-Credit)

Land Acknowledgement: "We acknowledge the land that Fort Lewis College is situated upon is the ancestral land and territory of the Nuuchiu (Ute) people who were forcibly removed by the United States Government. We also acknowledge that this land is connected to the communal and ceremonial spaces of the Jicarilla Abache (Apache), Pueblos of New Mexico, Hopi Sinom (Hopi), and Diné (Navajo) Nations. It is important to acknowledge this setting because the narratives of the lands in this region have long been told from dominant perspectives, without full recognition of the original land stewards who continue to inhabit and connect with this land. Thank you for your attention and respect in acknowledging this important legacy."

1. Professor:

Yiyan Li: BH601, yiyanli185@gmail.com, yli@fortlewis.edu

Office Location: BH 601

Lectures: MWF 11:15 am – 12:10 pm, BH570

Office Hours: MWF, 9 am - 11 pm, 8/25/2025 – 12/5/2025

Course Website

2. Course Overview

This course introduces students to the typical architecture and internal components of a microcontroller and its application to analog and digital embedded systems. Topics include programming in C, instruction and register sets, input/output operations for a given microcontroller family, interfacing with analog and digital signals and devices, serial communications, interrupts and service routines, process priority, and timing analysis. The class will use a custom development board—the Skyboard, which features the ATMEGA2560 MCU with numerous peripherals, including sensors, amplifiers, audio filters, an SD card, an IR emitter/receiver pair, and a speaker. Students will use Fusion 360 for embedded system-level PCB design as part of the course project. This course prepares students for embedded software and hardware development roles in the industry.

3. Course Topics and Schedule

Week 1-2	Digital and Embedded C Basics, The Skyboard Basics
Week 3	Timer
Week 4	Use the MCU to Play a Sound through the Audio Amplifier and the Speaker
Week 5-6	PWM, State Machine, and IR
Week 7-8	Signal Acquisition, ADC, and LPF
Week 9-10	Microphone and Frequency Measurement
Week 11-12	SD Card, Blocks and Pages

Week 13-14	Sound Play Back and Course Project

4. Course Learning Outcomes (with associated ABET criteria):

After completing CE 351 students will be able to:

- Design an embedded system using microcontrollers. (1, 2)
- Using microcontrollers for data acquisition. (1, 2)
- Using microcontrollers for signal processing. (1, 2, 6)
- Design a printed circuit board for industrial applications. (1, 2, 6)
- Design a GUI to communication with microcontrollers. (1, 2)

5. Engineering Program Student Learning Outcomes (ABET criteria)

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. 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.

3. an ability to communicate effectively with a range of audiences.

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

6. Prerequisite

CE 241 Fundamentals of Computer Logic at least C- and ENGR 201 Electric Circuit I at least C-.

7. Textbook

Sepehr Naimi et al.. The AVR Microcontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel Studio.

ATMEGA2560 datasheet:
https://ww1.microchip.com/downloads/aemDocuments/documents/OTH/ProductDocuments/DataSheets/ATmega640-1280-1281-2560-2561-Datasheet-DS40002211A.pdf

Tutorials on my website:

www.yilectronics.com

8. Grading, Homework assignments, Quizzes, and Exams

Homework assignments and quizzes 50%, midterm 10%, project reports 30%, Final 10%.

A: 93-100, A-: 90-92, B+: 87-89, B: 83-86, B-: 80-82, C+: 77-79, C: 73-76, C-: 70-72, D+: 67-69, D: 63-66, D-: 60-62, F: <60

Homework assignments are lab reports that you should upload to the website. (Instructions for how to do this will be available to you).

9. Policies

Regularly being tardy for lectures, leaving in the middle of lectures, or earlier from lectures is unacceptable without prior consent of the instructor.

Cheating or plagiarism will result in an automatic F grade in the course (so do your own homework and projects).

****"Fort Lewis College is committed to providing all students a liberal arts education through a personalized learning environment. If you think you have or you do have a documented disability which will need reasonable academic accommodations, and/or if you are a Veteran who may need services, please contact the Disability Services Office, 280 Noble Hall, 970-247-7383, disabilityservices@fortlewis.edu for an appointment as soon as possible."

Canvas

Online materials (lecture notes, homework assignments, quizzes) will be available at Canvas or on the professor's course webpage. If you are not familiar with Canvas, please work through the Student Canvas Orientation. For technical help with Canvas contact the 24/7 support hotline at 855-971-1611 or submit a HELP ticket in Canvas.

Course Expectations

Credit Hour Syllabus Statement

In addition to spending 3 hours per week attending class, the typical student in this 4 credit lecture course/labs should expect to spend at least 6 hours per week of concentrated attention on course-related work, including but not limited to time spent reading, reviewing, organizing notes, preparing for upcoming quizzes/ exams, problem solving, developing and completing projects, and other activities that enhance learning.

Academic Integrity

Academic dishonesty includes all forms of unethical or illegal behavior which affects a student's academic standing, including, but not limited to, cheating on exams, plagiarism, forgery of academic documents, falsification of information on academic documents, or unauthorized access to computer files containing academic information. Academic dishonesty may result in sanctions ranging from a lowered grade on a particular assignment to an "F" in the class and report submitted to the Office of the Vice President of Academic Affairs.

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<u>Land Acknowledgement:</u>

Please consider adding a Land Acknowledge to your syllabus. See the President's Office Land Acknowledgement page (https://www.fortlewis.edu/about-flc/leadership/presidents office/landacknowledgment) for the current FLC Land Acknowledgement.

Basic Needs Statement:

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their learning experiences is urged to contact Kate Suazo, *Professional Advocate and Case Manager*, for support (cmsuazo@fortlewis.edu; 970-822-8728).

FLC students may be eligible for SNAP benefits. Please contact Marissa Hunt, *Resource Center Manager* at Manna. 970-385-5095, ext. 3, or email: services@mannasoupkitchen.com.

In addition, the FLC Grub Hub is a student-led, food justice organization committed to serving students and their families by sharing free food for all. Please come visit the Grub Hub in their new location in the Student Union across from the post office to learn more.

Reach Out for Success Statement:

College students encounter setbacks from time to time. If you encounter difficulties and need assistance, it's important to reach out. Consider discussing the situation with an instructor, academic advisor, peer support office, or counselor. Learn about resources that assist with wellness and academic success at: https://www.fortlewis.edu/life-at-flc/student-services/student-affairs/student-affairs-home

If you or someone else is in immediate crisis, please call the local 24-hour crisis hotline (970) 247-5245, call the Colorado 24-hour crisis hotline (844) 493-8255, text "TALK" to 382555, or call the FLC Counseling Center during regular business hours (970) 247-7212.

Students as Parents Statement:

I am aware that it can be challenging to be a parent while enrolled in college courses and want to support parents to successfully pursue their education. If you are unable to attend class due to children's illnesses or unforeseen disruptions in childcare, please contact me.