

## Course Syllabus

### CE 351 Microcontrollers (3-Credit)

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#### 1. Professor:

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#### 2. Course Overview

This course introduces students to the typical architecture and internal units of a microcontroller and its application to analog and digital embedded systems. Topics include: Programming in C, instruction and register sets and input/output for a given microcontroller family, interfacing of analogue and digital signals and devices, serial communications, interrupts and service routines, process priority, and timing analysis. Some industrial standard microcontrollers such as ESP8266, ESP32, ST32 ARM Core, TI MSP430, and others will be used in the final project.

#### 3. Course Topics and Schedule

<i>Week 1-2</i>	Power Supply Circuit for MCUs
<i>Week 3</i>	Arduino Basics
<i>Week 4</i>	Display, Sensors
<i>Week 5-6</i>	PID Controllers, IMUs
<i>Week 7-8</i>	Smart Car Design
<i>Week 9-10</i>	ATMega 328 Advanced Applications (IOT, ESP8266, and Thingspeak)
<i>Week 11-12</i>	Advanced IoT Devices (ESP32)
<i>Week 13-14</i>	STM32 Microcontrollers and MSP430 Microcontrollers

#### 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/CE341 Fundamentals of Computer Logic, at least C- OR ENGR338 (2018 and before), at least C-.

## **7. Textbook**

ATMega 328p datasheet: [https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P\\_Datasheet.pdf](https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf)

ESP32 Series datasheet:

[https://www.espressif.com/sites/default/files/documentation/esp32\\_datasheet\\_en.pdf](https://www.espressif.com/sites/default/files/documentation/esp32_datasheet_en.pdf)

Tutorials on my website:

[www.yilelectronics.com](http://www.yilelectronics.com)

## **8. Grading, Homework assignments, Quizzes, and Exams**

Homework assignments and quizzes 40%, midterm 20%, project reports 20%, Final 20%.

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).

Quizzes will be done in class. I'll notify you 1 week prior to the day that has a quiz.

There is only one final exam for this course. No midterm and other exams.

## **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](mailto:disabilityservices@fortlewis.edu) for an appointment as soon as possible."