Number: ENGR 260 (Section 01)  
Title: Microcontroller Systems  
Credits: 4 credits

Course Format: Three one-hour lectures per week. One two-hour lab. per week.

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Catalog Description:  
This is an introductory course on microprocessor and microcontroller systems organization. It provides low-level programming principles for microcomputer-based systems. The course emphasizes assembly and C language programming techniques and laboratory experiments in input/output programming, memory organization, interrupts, and interfacing methods.

Learning Objectives (and corresponding mapping to ABET Criteria 3): Upon completion of this course, students will be able to:

1. Describe the characteristics and uses of microcontroller systems (ABET 3j)
2. Interpret memory maps (ABET 3k)
3. Describe a microcontroller’s architecture in terms of its main building blocks (ABET 3j).
4. Write Assembly and C programs using looping, branching, arithmetic operations, and data manipulation (ABET 3a, 3c, 3e).
5. Describe the concepts of stack, interrupts and resets, and organize code in segments using pseudo-operations (ABET 3j).
6. Describe fundamental characteristics of parallel ports, and programmable timer (ABET 3j).
7. Use software and hardware tools for converting source code in executable machine code and download it to the target microcontroller (ABET 3j, 3k).
8. Write Assembly and C programs to implement basic design projects (ABET 3b, 3c).


Prerequisites: ENGR 160 (Digital Circuits), CSCD 255 (C programming for engineers) or consent of the instructor.

Topics:
- Introduction to Microcomputer Systems
- Information Representation
- Microcomputer Architecture
- Assembly Language Programming
- I/O Programming
- Interfacing Techniques

Computer Usage:
1. Code compilation, simulation of program operation, downloading of code to the target microprocessor, and control of the microprocessor during debugging is done using PCs, various software tools, and a microcontroller development board.
2. Design projects and laboratory assignments require writing formal technical reports with word processors and graphics software for their presentation.
Laboratory:
Laboratory experiments require an understanding of microcontroller’s building blocks, hardware interfacing techniques, low-level and high-level programming languages, a basic understanding of programs compilation process, and involve the use of various software tools, personal computers, microcontroller development board, writing skills and teamwork

Grading:  
A = 3.5–4.0 (90–100%), B = 3.0–3.4 (80–89%), C = 2.0–2.9 (70–79%),  
D = 1.0–1.9 (60–69%), F = 0.0 (0–59%)  
Homework: 10%  
Labs 30%  
Midterm exam: 30%  
Final exam/project: 30%

Course Outcomes and mapping to ABET Criteria 3:
   a. An ability to apply knowledge of mathematics, science, and engineering.
      Students are required to use their background in mathematics, physics and engineering to successfully complete homework, labs, and exams.
   b. An ability to design and conduct experiments, as well as to analyze and interpret data.
      Students are required to design and implement lab experiments for programming, analyzing and debugging basic microcontroller based systems.
   c. An ability to design a system component, or process to meet desired needs within realistic constraints.
      Homework and laboratory experiments require students to analyze, design, evaluate, and improve programs that meet specified constraints.
   d. An ability to function effectively on multi-disciplinary teams.
      n/a
   e. An ability to identify, formulate, and solve engineering problems
      Homework, labs, and exams require students to identity, formulate, model and solve several engineering challenges.
   f. An understanding of professional and ethical responsibility.
      n/a
   g. An ability to communicate effectively.
      Students need to write several lab. reports and work in team.
   h. Understand impact of engineering solutions in a global, economic, environmental and societal context
      n/a
   i. A Recognition of the need for, and an ability to engage in life-long learning
      Students must independently learn how to use unfamiliar computer systems and software tools to solve technical problems
   j. A Knowledge of contemporary issues
      Homework and lab. experiments are based on state of the art software and hardware tools.
   k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
      Lab. experiments require the use of current methodologies and hardware and software tools.