THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Introduction to Microcontroller-Based Systems

ECE 2560

Credit Hours:
2.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture

Course Description:
Hardware and software organization of a typical microcontroller; machine language programming, interfacing peripheral devices, and input-output programming; real-time computer applications.

Prerequisites and Co-requisites:
Prereq: 2000, 2001, 2060, or 2061 and prereq or concur: 2000.07 or 2017; and CSE 1221, 1222, Engr 1281.01H, 1281.02H, or 1222, and enrollment in ECE, CSE, or EngPhysics major; or prereq or concur: 2010 or 2067, and permission of department.

Course Goals / Objectives:
- Learn the architecture, programming, and interface requirements of a commercially used microprocessor.
- Learn to interface a microcontroller to memory, parallel ports, serial ports, etc.
- Learn to apply microcontroller systems to solve real-time problems.

Course Topics:

- Intro to digital signals. Intro to Number Systems. Binary and Hexadecimal numbers. Conversion between number systems. 1's complement.
- 2’s complement. Signed and Unsigned Numbers. Addition and subtraction of binary numbers. Overflow and detecting overflow. Division and multiplication of 2’s compliment numbers using bit-shifting.
- Introduction to the Launchpad. Pushbuttons and LEDs on the Launchpad. Pin Schematic. Functional block diagram. Address and Data buses. CPU, Ports and GPIO.
- I/O interfacing and programming
- Memory mapping. ROM/Flash and RAM. Von Neumann and Harvard Architectures. Details of FLASH and ROM and memory mapping. Core registers.
- Machine Language. Assembly Language. Instructions and assembler directives. Syntax and formatting
- Intro to Code Composer Studio (CSS)
- Transferring data between registers Addressing odes. Use o indexed mode and indirect register modes to index arrays.
- The V, Z, N, and C status bits in the Staus Register. Conditional jumps (JZ/JEQ, JNZ/JNE, NHS, JLO, JGE, JL, JC, JNC). BIt testing via BIT instruction.
- Pseudo code. Flowcharts. Conditional Statements. For-loop, If-structure. If-else-structure.
- Handling cond1 && cond2. Handling cond1 || cond2. switch-case statement
- Intro to the Stack. Push and pop. Local Variables
- Introduction to Subroutines. Calling convention.
- Handling stack-based local variables. Handling stack-based local variables
- Programs using multiplication and division using bit shifting. RLA and RRA instructions. Impoarting and Plotting Data in CCS. Binary fixed point numbers and Q format.
- Ports in detail. Configuring the ports for GPIO. Active high and active low switches. Pull up and pull down resistors.
- Interrupts. Interrupt Service Routines. Interrupt Vector Table
- Low Power Modes

Designation:

Required
Elective