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.
- Tri-state buffers. Registers and Counters. Transferring data between registers. Active high and active low switches. Pull up and pull down resistors.
- Introduction to the Launchpad. Pushbuttons and LEDs on the Launchpad. Pin Schematic. Functional block diagram of the microcontroller MSP430G2553. 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 of MSP430G2553.
- Machine Language. Assembly Language. Core Registers. Intro to CCSv5 Part I
- Intro to CCSv5 Part II
- Intro to CCSv5 Part III. Preprocessor Directives I
- Intro to CCSv5 Part IV. Preprocessor Directives II
- Index Mode and how to index arrays. The V, Z, N and C status bits in the Status Register
- Pseudo Code. Flowcharts. Conditional Statements
- JNZ, JL and JGE instructions
- JE and JNE instructions. Bit testing via BIT instruction. Bit conditionals using JC and JNC jump instructions. If-structure. If-else-structure
- For-loop
- Handling cond1 && cond2. Handling cond1 || cond2. switch-case statement
- Intro to the Stack. Push and pop. Local Variables
- Indirect Register Mode. RLA and RRA instructions. Introduction to Subroutines
- Handling register based local variables. Handling stack based local variables
- Handling stack based input and output variables. Programs using multiplication and division using bit shifting. Importing and Plotting Data in CCS
- Ports in detail. Configuring the ports for GPIO
- Interrupts. Interrupt Service Routines. Interrupt Vector Table
- Low Power Modes

Designation:
Required
Elective