ESET 220 Microprocessor Systems

Course Description: The goal of this course is to introduce the concept of interfacing and programming with microcontrollers and related peripherals. The students will become familiar with programming both in assembly language as well as C/C++ in addition to learning about parallel and serial communication protocols and timer systems. Students will also develop a course mini-project utilizing the MSP430 microcontroller.

Prerequisites(s): EET 122 **Corequisite(s):** No corequisite

Lecture Hours: 3	Lab Hours: 2	Credit Hours: 4
Lab Fee: 70	Supplemental Fee: 0	Purpose:
☐ Transfer Assurance Guide Course (TAG)	☐ Transfer Module Course (TM)	
Course Format: Lec/Lab	Grading: A/B/C/D/F/I	
Delivery Method: □ Web	□ Hybrid	x Classroom
Semesters Offered: x Fall	x Spring	x Summer

Course Primary Text:

Supplemental Materials:

(1) Students will need to purchase the MSP430 FR6989 LaunchPad Development Kit from Texas Instruments (MSP-EXP430FR6989). It is $17.99 and can be found at the following website: http://www.ti.com/lsds/ti/tools-software/launchpads/launchpads.page
(2) If students are interested in doing a large amount of the development on their own computer (highly recommended), they should download the TI Code Composer Studio from here: http://www.ti.com/tool/ccstudio
(3) To help in the development of C/C++ programming skills, students should download the free student version of Microsoft Visual Studio. This can be found here: https://www.visualstudio.com/vs/cplusplus/

Course Outcomes:

Use of Microcontrollers vs Microprocessors

- Applications of both microcontrollers and microprocessors
- Programming options for microcontrollers
- IDE environments

Effective microcontroller programming in C/C++

- Basic C/C++ programming using Microsoft Visual Studio
- Use of loops and subroutines
- Mathematical concepts in C/C++ including Boolean analysis
- Use of global variable programming

Effective microcontroller programming in assembly

- Introduction to the MSP430 RISC architecture
- Advantages of assembly vs. higher level languages
- Use of Code Composer Studio for real-time register analysis

Communication with I/O ports

- Ability to configure ports as both input and output
- Accessing on-board LEDs
- Accessing on-board ADCs

Serial and parallel communication protocols

- Advantages and disadvantages of serial and parallel communications
- Code protocols for serial and parallel communications
- Linking with serial and parallel devices through the I/O ports

Communication with external device structures

- Transmitting data to/from external sensor devices
- Demonstration of external device control with microcontroller

Accessing display devices

- Interfacing code with the on-board LCD
- Including LCD use with external device control

Timers and IRQ protocols

- Understanding various timing systems on microcontroller
- Working with interrupt request (IRQ) protocols
- Interfacing with multiple ports/devices utilizing IRQ hierarchy.

Course Topics:

Week 1	Basic 6812 I/O Ports
Week 2	Stepper Motor interface and control algorithms
Week 3	Stepper Motor applications and control software
Week 4	Input Capture. Period measurement of signals and frequency calculations
Week 5	Basic Timer Concepts for the 6812 Microcontroller
Week 6	Output Compare. Waveform generation using built-in timer subsection
Week 7	Applications of the Input Capture subsection
Week 8	Event counting using the Pulse Accumulator subsection.
Week 9	Applications of the Output Compare Subsection
Week 10	Pulse Width Modulation. Power control circuits and control efficiency

	Pulse Accumulator operation and applications
Week 11	Use of Pulse Width Modulator subsection.
Week 12	Analog to Digital converter subsection and applications Analog to Digital inputs. Temperature and positional measurements.
Week 13	Real time Interrupts and applications
Week 14	Real Time Interrupts. Processor efficiency and multi-tasking.
Week 15	Final Exam

Methods of Evaluation/Assessment

CLASS WORK (50%)
Homework (20 %)
Midterm (40 %)
Final Examination (40%)

LAB WORK (50%)
Attendance/Timeliness/Preparedness (20%)
Lab Performance/Results (40%)
Lab Reports (40%)

93-100	A	72-76	C
90-92	A-	69-71	C-
87-89	B+	67-68	D+
82-86	B	62-66	D
80-81	B-	59-61	D-
77-79	C+	0-58	F

Course Keeper: Ralph Whaley

Date Completed: 4/19/2019