

ECE 2560: Introduction to Microcontroller-Based Systems

Course Description

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

Prior Course Number: 265

Transcript Abbreviation: Intro Micro Sys

Grading Plan: Letter Grade

Course Deliveries: Classroom

Course Levels: Undergrad

Student Ranks: Sophomore, Junior

Course Offerings: Autumn, Spring

Flex Scheduled Course: Never

Course Frequency: Every Year

Course Length: 14 Week

Credits: 2.0

Repeatable: No

Time Distribution: 2.0 hr Lec

Expected out-of-class hours per week: 4.0

Graded Component: Lecture

Credit by Examination: No

Admission Condition: No

Off Campus: Never

Campus Locations: Columbus

Prerequisites and Co-requisites: Prereq: 2000, 2060, 2061, 270, 290, 294.01, or 261, or 2001 and prereq or concur: 2000.07 or 2017; and EnGraph 167, CSE 1221 (205), 1222 (202), Engr 1281.01H, 1281.02H, 1222, Engineer 192.01H, or 192.02H, and enrollment in ECE, CSE, or EngPhysics major; or prereq or concur: 2010 or 2067, and permission of department.

Exclusions: Not open to students with credit for 265 or CSE 2421 (360).

Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: Yes

The course is a GEC: No

The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.0902

Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

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

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Intro to digital signals. Intro to Number Systems. Binary and Hexadecimal numbers. Conversion between number systems. 1's complement.	1.0							
2s complement. Signed and Unsigned Numbers. Addition and subtraction of binary numbers. Overflow and detecting overflow. Division and multiplication of 2s compliment numbers using bit-shifting.	1.0							
Tri-state buffers. Registers and Counters. Transferring data between registers. Active high and active low switches. Pull up and pull down resistors.	1.0							
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.	1.0							
I/O interfacing and programming	8.0							
Memory mapping. ROM/Flash and RAM. Von Neumann and Harvard Architectures. Details of FLASH and ROM and memory mapping of MSP430G2553.	1.0							
Machine Language. Assembly Language. Core Registers. Intro to CCSv5 Part I	1.0							
Intro to CCSv5 Part II	1.0							
Intro to CCSv5 Part III. Preprocessor Directives I								
Intro to CCSv5 Part IV. Preprocessor Directives II	1.0							
Index Mode and how to index arrays. The V, Z, N and C status bits in the Status Register	1.0							
Pseudo Code. Flowcharts. Conditional Statements	1.0							
JNZ, JL and JGE instructions	1.0							
JE and JNE instructions. Bit testing via BIT instruction. Bit conditionals using JC and JNC jump instructions. If-structure. If-else-structure	1.0							
For-loop	1.0							
Handling cond1 && cond2. Handling cond1 cond2. switch-case statement	1.0							
Intro to the Stack. Push and pop. Local Variables	1.0							
Indirect Register Mode. RLA and RRA instructions. Introduction to Subroutines	1.0							
Handling register based local variables. Handling stack based local variables	1.0							
Handling stack based input and output variables. Programs using multiplication and division using bit shifting. Importing and Plotting Data in CCS	1.0							
Ports in detail. Configuring the ports for GPIO	1.0							
Interrupts. Interrupt Service Routines. Interrupt Vector Table	1.0							
Low Power Modes	2.0							

Representative Assignments

Quizzes
Midterms

Project
Final exam

Grades

Aspect	Percent
Quizzes	20%
MT1	20%
MT2	20%
Project	15%
Final	25%

Representative Textbooks and Other Course Materials

Title	Author
<i>MSP430 Microcontroller Basics</i>	J. Davies

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CpE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
*	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

Course Contribution		Program Outcome
	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
*	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

EE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
*	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 judgment to draw conclusions
*	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Additional Notes or Comments

Required core for both EE and CpE programs.

Changed prereqs to include ECE 290 and 294.01 1/17/12

Deleted "206" from prereq .

Added 261 to prereq. 11/1/12

updated prereqs to remove 261 and add 20007 and 270. 4/5/12

Deleted text - F.K. will advise when correct material is chosen, 4/3/12.

Updated programming rereqs to EnGraph 167, CSE 1221 (205), 1222 (202), Engineer 192.01H, 192.02H 1281.01H, 1281.02H or 1222 May 7, 2012

ADded text approved by compeer area 6/6/12

Added

"or prereq or concurrent 2010 and permission of department." to prereq 10/20/13

Rewritten course goals, expansion of topics, revision of grading scheme and representative assignments 5/25/13 BLA

Add 2060, 2061 to prereqs and 2067 to coreqs. 9/8/15 BLA

Sync with univerty version 11/20/15

Updated text info, 5/9/17, CED

Deleted one course goal, added new outcomes.

Prepared by: Betty Lise Anderson