

CSCE 313: EMBEDDED SYSTEMS LABORATORY

Catalog Description:

313—Embedded Systems. (3) (Prereq: CSCE 211, 212) Fundamentals of embedded systems; hardware components, software components, hardware/software interface design, and hardware/software co-design.

Prerequisite(s) By Topic:

Computer architecture

Textbook(s) and Other Required Material:

I. Scott MacKenzie, *The 68000 Microprocessor*, Prentice Hall, Englewood Cliffs, NJ, 1995.

I. Scott MacKenzie, *Lab Manual 68KMB*, available at the author's web page:

<http://www.yorku.ca/mack/68KMB-Labs-merged.PDF>.

Computing Platform: DOS, 68000 microcomputer, WISM68K Software Simulator Tool Set

Course Objectives: {Assessment Methods Shown in Braces}

1. Demonstrate knowledge of the microprocessor architecture, instruction set, and operation. {tests, lab reports}
2. Write, assemble, link, execute, and debug programs running on a single board microcomputer. {tests, lab reports}
3. Interface the single board microcomputer to a variety of peripheral devices using serial and parallel communications. {tests, lab reports}
4. Measure the execution times of programs running on a single board microcomputer. {test, lab reports}
5. Communicate technical information in written reports. {lab reports}

Topics Covered:

1. Introduction to embedded systems (3 hours)
2. Virtual machine layers; the ISA (instruction set architecture) layer (1 hour)
3. Motorola 68000 architecture (1 hour)
4. Motorola ISA layer (6 hours)
5. Assembler program development (3 hours)
6. Programming examples (3 hours)
7. Instruction format and instruction timing (3 hours)
8. I/O interfacing: Principles and examples (3 hours)
9. The 68KMB Embedded Processor Board (3 hours)
10. Software engineering of 68K programs for reactive real-time systems (3 hours)
11. Review and examinations (3 hours)

Laboratory Projects:

Students do approximately 13 laboratory exercises working in groups of two. The exercises require that they program the 68000 microcomputer and associated peripheral devices. Programs are assembled, linked, loaded, and traced using DOS on a PC.

Syllabus Flexibility: Low. The Undergraduate Committee approves the choice of textbook and syllabus.

Relationship of Course to Program Outcomes:

The contribution of each course objective to meeting the program outcomes is indicated with the scale:

3 = major contributor, 2 = moderate contributor, 1 = minor contributor. Blank if not related.

Course Objectives	Program Outcomes										
	1. Logic & Math	2. Computing Fundamentals	3. Apply Computing Principles	4. Work on teams	5. Communicate Effectively	6. Liberal arts & Soc. Sciences	7. Basic Science and Lab Procedures	8. Learn New Tools & Processes	9. Employed upon Graduation	10. Application Area	11. Electronics and Digital Sys Design
1. Demonstrate knowledge of micro-processor architecture, instruction set, and operation.			3						1		3
2. Write, assemble, link, execute, and debug programs running on a single board microcomputer.		3	3	1					1		2
3. Interface the microcomputer to a variety of peripheral devices.		3		1				2	2		3
4. Measure the execution times of programs		3	3	1			2				
5. Communicate technical information in written reports.					3				2		

Estimated Computing Category Content (Semester hours):

Area	Core	Advanced	Area	Core	Advanced
Algorithms			Data Structures		
Software Design			Programming Languages		
Computer Architecture		3			

Estimated Information Systems Category Content (Semester hours):

Computer Information Systems majors do not take this course.

Oral and Written Communication:

Each student writes about 10 lab reports during the course

Social and Ethical Issues: None

Theoretical Content: None

Analysis and Design:

Some low level, assembler language programming, interfacing peripheral devices

Collaborative Work:

Students work in pairs for laboratory exercises

Class/Laboratory Schedule:

Lecture: 1 period of 75 minute per week

Laboratory: 1 supervised period of 2 hours per week + unscheduled laboratory time.

Course Coordinator: Jim Davis

Modification and Approval History:

Initial description, April 1999

Revised for merger, March 2000

Revised April 2001

Revised June 2005 by Caroline Eastman for topic list based upon class notes from Jim Davis and for format