ELECTRICAL, COMPUTER, AND SYSTEMS ENGINEERING DEPARTMENT

ABET COURSE SYLLABUS

ECSE-4790: Microprocessor Systems Design

Course Catalog Description: A capstone design course. This course integrates hardware and software for real-time microprocessor based digital systems. Laboratory exercises are included to facilitate hardware and software development techniques practiced in industry. Pre-requisites: ECSE-2610 and ENGR_2350. Co-requisites ENGR-4010 and senior standing. Fall term annually. *3 credit hours*

Pre-Requisite Courses: ECSE-2610 Computer Components and Operations and ENGR-2350 Embedded Control

Co-Requisite Courses: ENGR-4010 Professional Development III and senior standing

Prerequisites by Topic:

1. Fundamentals of logic design
2. Digital & analog circuit theory
3. Computer programming
4. Computer instruction sets and microcontroller operations

Textbook: (and/or other required material)
Fredrick Cady & James Sibigtroth, Software and Hardware Engineering, Oxford University Press, New York, NY 2000

References:

Gene H. Miller, *Microcomputer Engineering,* Second Edition, Prentice Hall, Englewood Cliffs, NJ 1998. (First Edition is fine.)
Thomas L. Harman, *The Motorola MC68332 Microcontroller*, Prentice-Hall, Englewood Cliffs, NJ, 1991. (Easier to read than Motorola literature.)
Alan Clements, *Microprocessor Systems Design*, PWS Publishing Company, Boston, MA, 1992
Kim R. Fowler, *Electronic Instrument Design*, Oxford University Press, New York, NY 1996
Online: www.ecse.rpi.edu/Courses/CStudio or http://www.rpi.edu/, pick “my WebCT”, login & pick “Microprocessor Systems Design”

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Overall Educational Objective: To provide senior ECSE students with a team-based capstone experience in microprocessor system design and to enhance their oral and written communication skills.

Course Learning Outcomes:

6 of 7, by choice of labs

1. Create a service routine that performs a function on the occurrence of an IRQ hardware interrupt
2. Use a counter to control the accurate timing of a stopwatch display
3. Connect RS-232 and SPI devices to the HC12 processor and write programs to pass data to and from them
4. Interface a static RAM memory chip to the HC12 processor at address 2000_{16} and write a program to verify operation
5. Develop a routine to read an analog input on an ADC port and detect peak voltages
6. Interface the Hitachi HD44780 LCD panel to the HC12 and write a program to display a message on it
7. Write a program to display messages on an ANSI terminal with attributes for position, color, background color, and animation.

How Course Outcomes are Assessed: Part of each grade will be determined by the team effort and part by individual effort. For the lab exercise reports, individual responses to TA questions while verifying the exercise results determines 15% of the grade while 85% is determined by the team. A more detailed breakdown of the team vs. individual grading on the semester project is given in the course project description handout.

Teams of 2 students

38%	5 MC6812 exercises (breakdown below)

Teams of 3 or 4 (5 in special cases) students

62%	Student selected course project
5%	Course project proposal
10%	Interim demonstration
12%	Interim progress report
34%	Final demonstration/presentation
25%	Final project report
4%	Project Notebook
10%	Post-project clean up, peer reviews, & teamwork
100%	TOTAL (x 62%)

NOTE: The five exercises are not weighted equally in adding up to the 38% of your overall course grade. The weights are:

D-Bug 12/ANSI Terminal	10%
Interrupts	10%
Memory Interfacing	25%
Serial Communications/ AD Conversions	20%
Magic 8 Ball	35%
TOTAL (x 38%)	100%

Relation to EE/CSE/EPE Outcomes

N = none
M = moderate
H = high

Outcome	Level	Demonstrate Proficiency
	N, M, H	e.g. Exams, projects, HW
Mathematics, science and engineering	N	
Basic disciplines in Electrical Engineering	N	
Depth in Electrical Engineering	M	Lab ex. & Project
Basic disciplines in Computer & Sys. Eng.	M	Lab ex. & Project
Depth in Computer and Systems Eng.	M	Lab ex. & Project
Electromagnetics, electromechanics, power semiconductors	N	
Power system behavior	N	
Electrical energy conversion	N	
Conduct experiments and interpret data	M	Lab ex. & Project
Identify, formulate and solve problems	N	
Design a system, component or process	H	Lab ex. & Project
Communicate in written and oral form	H	Project Rpt & presentation
Function as part of a multi-disciplinary team	H	Lab ex. & Project
Preparation for life-long learning	M	Lab ex. & Project
Ethical issues; safety, health, public welfare	M	Lab ex. & Project
Humanities and social sciences	N	
Laboratory equipment and software tools	H	Lab ex. & Project
Variety of instruction formats	N	

Topics Covered:
(number of hours or classes for each)

1. Brief overview of available development environment tools (cross-assembler, C cross-compiler, & simulator/debugger) and other platforms (MC6811 & MC68332 microcontrollers)
2. Hardware & software development techniques
3. ANSI terminal escape sequences

	4. Interrupts & timers 5. Memory bus interfacing 6. Synchronous & asynchronous serial communications 7. A/D conversion 8. I/O interfacing of a keypad & LCD panel 9. Inter-processor communication 10. Fuzzy logic control.
Computer Usage:	All exercises and the course project integrally use microcomputers.
Laboratory Experiences:	1. D-Bug 12 environment 2. ANSI terminal programming 3. Interrupts and timers programming 4. Interfacing memory to the microprocessor 5. Serial communications 6. AD conversions 7. I/O programming with an LCD panel & keypad 8. Course project
Design Experiences:	The design experiences vary depending on the course project selected, but all involve: 1. Proposal of a design and method of implementation 2. Building, troubleshooting, & possible re-engineering 3. Finalization of completed design and thorough documentation and analysis
Independent Learning Experiences:	Although students work in teams, they are assigned individual tasks for the project which require: 1. Research of solutions 2. Purchasing components 3. Reading data sheets 4. Figuring out how to get subsystems to function correctly
Class/Lab Schedule:	1 hr/wk of lecture, 5 hrs/wk of laboratory
Contribution to the Professional Component:	(a) College-level mathematics and basic sciences: 0 credit hours (b) Engineering Topics (Science and/or Design): 3 credit hours (c) General Education: 0 credit hours

Prepared by:	Russell P. Kraft
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