Syllabus

Course Description: Organization of computer systems: processor, memory, I/O organization, instruction encoding and addressing modes. Introduction to microprocessors, control unit, and interrupt system design. Design of hardware and software for microprocessor applications. Assembly language programming. Microprocessor system case studies.

Prerequisites: EECE 251 and CS 211

Required Texts: *available from the bookstore, or via a free link on Moodle (http://www.bumoodle.com)*

- Summerville Embedded Systems Interfacing for Engineers using the Freescale HCS08 Microcontroller I: Assembly Language Programming Morgan & Claypool, 2009. ISBN: 978-1608450053
- Summerville Embedded Systems Interfacing for Engineers using the Freescale HCS08 Microcontroller II: Digital and Analog Hardware Interfacing Morgan & Claypool, 2009. ISBN: 978-1608450084

References: *available on Moodle*

- Freescale Semiconductor, *HCS08 Family Reference Manual*
- Freescale Semiconductor, *MC9S08QG8/MC9S08QG4 Data Sheet*

Materials and Supplies:

- For many of the labs for this course, you will be required to use the department's robotics platform. If you do not have a robot kit, please contact one of the course instructors.
- For this course, you will need to purchase a collection of several sensors and actuators for use with your robot, at a total cost of around $60. More information and purchasing instructions are available on Moodle.
- You will also need several components from the Circuits (EECE 260) lab kit.
- We will be using the Freescale USB Spyder development kits, which will be available in the lab for your use. You will be provided with a microcontroller to use during the first lab session. The free *Codewarrior* software we will be using in lab is available on Moodle.

Course Topics

1. Organization of digital computer systems: processor, memory, I/O
2. Instruction set architecture: Instruction encoding, machine code, and addressing modes.
3. Assembly language programming.
4. Microcontroller system design. Microcontroller interfacing, input/output.
5. Design of integrated hardware and software for microcontroller applications.

Course Objectives

1. Determine when an embedded microcontroller is an appropriate and effective solution to apply toward a particular design problem.
2. Perform arithmetic operations on both signed and unsigned integer and fixed-point binary numbers and determine when there is an overflow condition.

3. Write sequences of assembly language instructions that implement high-level operations such as expression evaluation, array and table access, conditional execution, and looping.
4. Analyze a sequence of assembly language instructions to determine its execution time as well as how it affects the contents of registers and memory.
5. Write, debug, and test modular assembly language programs using subroutines.
6. Use stack memory in assembly language programs for local variable storage, subroutine parameter and result exchange, and temporary storage.
7. Develop both the hardware glue logic and assembly language software interface necessary to integrate analog and digital hardware components into a microcomputer using polled I/O techniques.
8. Write an interrupt service routine that asynchronously handles data flow to/from a peripheral device and be able to access the data and from a user program.
9. Develop a microcomputer–based intelligent bridge that takes an analog signal, extracts information, and sends the processed data to the digital system via a standard digital interface.

Policies

Academic Honesty

All students must adhere to the Student Academic Honesty Code of the University and the Watson School (links below). The Department of Electrical and Computer Engineering has adopted a standard policy to enforce these codes for violations involving course work.

Category I violations result in a grade of 0 for the graded work plus a one letter course grade reduction. A Report of Category I Academic Dishonesty form is filed with the Provost's Office; if a prior report is already on file, the offense is automatically elevated to Category II. Category II violations result in at least a failing grade for the course plus any additional penalties determined by the Watson Academic Integrity Committee.

University Academic Honesty Code:
http://bulletin.binghamton.edu/program.asp?program_id=826
Watson School Academic Honesty Code:
http://www.binghamton.edu/watson/Watson_Academic_Honesty_Policy.pdf
ECE Department Academic Honesty Code Enforcement Policy
http://www.ece.binghamton.edu/documents/Academic_Honesty_Policy.pdf

Acceptable Collaboration

- Discussion of assignments/labs is encouraged, though each student is responsible for doing their own work. When working on a lab or assignment, you may not another student's work, past or present, as a "reference".
- You may work on lab exercises in groups of no more than 2 students. Each student will receive the same grade for the lab.
- Each student must work alone on homework and lab quizzes.

Grading

- In addition to earning an average course grade of 65 or better, you must pass at least one exam and complete each of the labs to receive a passing grade for this class.
- With possible exceptions, two short online homework assignments will be assigned per course topic: an ungraded homework assignment, and a graded homework quiz.
- No unexcused absences from exams or labs. If you are sick or otherwise unable to attend, contact one of the course instructors by email before the missed activity. No make-up exams or labs will be given without prior consent.
- No extra credit.

Rubric

		Grade Scale			
Homework Quizzes	20%				
Labs & Lab Quizzes	25%	≥95	(A)	≥77	(C+)
(weekly labs during assigned lab period,		≥90	(A-)	≥73	(C)
and lab quizzes completed online at		≥87	(B+)	≥70	(C-)
home)		≥83	(B)	≥65	(D)
Exams (2)	17.5% ea.	≥80	(B-)		
Final (cumulative)	20%				

Attendance

University policy is that you attend all lectures. I do not police this. If you come to lecture, you are expected to be there to learn. If you don't plan to pay attention, you are expected not to be a distraction; toward this end, please observe the following rules.

Class Rules

- No meals.
- Arrive on time.
- Silence cell phones and other devices before class begins.
- Laptops are okay for note-taking only.
- In class participation is encouraged, private conversations are not. If you have something to say, say it to the whole class.
- If I make a mistake, point it out.

This course is also offered under the articulation agreement between Binghamton University and SUNYIT. It is available to qualified students at Binghamton University via the distance learning system Enginet.