

ENG 364: Microcomputer Interfacing
 School of Engineering
 University of Guelph
 05-364
 Fall 2007

Course Outline

Instructor

Prof: Shawki Areibi
 Office: 2335, ext. 53819
 Email: sareibi@uoguelph.ca
 Web Site: <http://www.uoguelph.ca/~sareibi>
 Office Hours: Fridays, 11:00-13:00

Lab Coordinator & Teaching Assistants

Lab Coordinator	Teaching Assistant
Ben Beacock Room 2308, ext. 53873 bbeacock@uoguelph.ca	Ahmad Sghaier Room (323), ext 52132 sghaiera@uoguelph.ca

Lecture & Lab Schedule

Lectures	Day	Section	Time	Place
	Mon	01;02;03	13:30-14:20	MACK 116
	Wed	01;02;03	13:30-14:20	MACK 116
	Fri	01;02;03	13:30-14:20	MACK 116
Laboratory	Day	Section	Time	Place
	Thu	01	8:30-10:20	THRN 2307
	Tue	02	12:30-14:20	THRN 2307

Course Text

1. Huang *MC68HC12: An Introduction "Software and Hardware Interfacing"*, Thompson, 2005.

References

1. Motorola M68HC11/M68HC12 User Manual.
2. H. Stone, *Microcomputer Interfacing*, Addison Wesley.
3. Miner and Comer, *Physical Data Acquisition For Digital Processing*.
4. Handouts.

Course Contents, Goals and Objectives:

Embedded computer systems are electronic systems that include a microcomputer to perform a specific dedicated application. They are basically found in transportation systems, military defense, communication systems.

This course introduces students to small microprocessor-based systems, with an emphasis on embedded system hardware and software design. One of the objectives of the course is to provide the student with the necessary knowledge and experience to design and implement complex microcomputer-based data acquisition and control systems. This course will first review the basic concepts of single-chip microprocessors and controllers with an emphasis on the Motorola 68HC11/68HC12. The course will then introduce the following topics: Microprocessor architecture and structure; Assembly language programming and the use of high-level languages; Basic input/output including parallel communications with and without handshaking and serial protocols; Hardware and software timing; Using interrupts and exceptions.

Main topics to be Covered:

- Advanced programming: Assembly and other programming languages, stacks, interrupts and real time events, signal generation and timing measurements.
- Interfacing external devices to the computer i.e LCD displays, Switches and keyboards, DC and stepper motors.
- I/O Interfacing, Busses, Arbitration, Memory, DMA.
- Serial Communication and Data Acquisition Systems.

Relationships to other Courses & Labs:

ENG364 and its lab will teach you plenty about microcomputer interfacing and advanced architectures. Several other courses in the curriculum expand on ENG364:

- **ENG241, Digital Design**, “Pre-requisite”: Combinational/Sequential Logic Design.
- **ENG339, Signal Processing**, “Co-requisite”: Fundamental analysis and design techniques for signal processing systems.
- **ENG338, Embedded Architecture Design**: This course concentrates on the issues that arise in engineering of larger digital systems. Its students are exposed to requirements specification, higher level hardware description languages, hardware/software co-design.
- **ENG340, Introduction to Mechatronic Systems Design**: This course covers the design of mechatronic systems, such as robotics, which are synergistic combinations of components and controls drawn from mechanical engineering and computer science.
- **ENG442, Real-time Systems Design**: This course concentrates on real time issues in computer architecture, validation of timing constraints, real time system design and analysis techniques. It also surveys real time operating systems.

Tentative Schedule

Week	Date	Lecture Material	Text Book
#1	Sep 10-Sep 14	Microcontroller Concepts	Chapter 1
#2	Sep 17-Sep 21	Assembly Language Programming	Chapter 2 & 4
#3	Sep 24-Sep 28	Program Development	Chapter 3
#4	Oct 01-Oct 05	Parallel Port Interfaces	Chapter 7
#5	Oct 08-Oct 12	Interrupt Synchronization	Chapter 6
#6	Oct 15-Oct 19	Timing Generation and Measurements	Chapter 8
#7	Oct 22-Oct 26	Analog Interfacing and Data Acquisition	Chapter 10
#8	Oct 29-Nov 02	Data Acquisition Systems	Chapter 10
#9	Nov 05-Nov 09	Serial I/O Devices	Chapter 9
#10	Nov 12-Nov 16	Serial I/O Interfacing	Chapter 9
#11	Nov 19-Nov 23	Busses & Transmission Lines	Chapter 13
#12	Nov 26-Nov 30	Memory Interfacing	Chapter 13

Assignments

There will be 5 assignments throughout the term. The assignments will not be marked. Solutions will be posted for each assignment on the web page every other week.

Item	Handed In	Due Date	Topic
Assignment #1	Mon Sep 25 (Week #2)	-	HC11/HC12 Programming
Assignment #2	Mon Oct 09 (Week #4)	-	General Interfacing
Assignment #3	Mon Oct 23 (Week #6)	-	Data Acquisition Systems
Assignment #4	Mon Nov 06 (Week #8)	-	Serial Communications
Assignment #5	Mon Nov 06 (Week #10)	-	Memory Interfacing

Labs

ENG364 labs are an integral part of the course. The objectives of the laboratories are:

- to help you understand and assimilate the lecture material.
- to give you practical experience with the process of design and interfacing using Motorola MC68HC11 and MC68HC12.
- to you give you hands-on-experience with Assembly Language Programming and high level software language development such as C.

There will be “7 labs” throughout the term. The following are the due dates.

Item	Takes Place	Due Date	Topic
Lab #0	Tue/Thur (Week #1)	-	Equipement in the Lab
Lab #1	Tue/Thur (Week #2)	Tue/Thur (Week #3)	Introduction to MC68HC11/12
Lab #2	Tue/Thur (Week #3)	Tue/Thur (Week #4)	Parallel Port Programming
Lab #3	Tue/Thur (Week #4)	Tue/Thur (Week #5)	Keypad and LCD Interfacing
Lab #4	Tue/Thur (Week #5)	Tue/Thur (Week #7)	Servo Motor Control/Hex Keypad
Lab #5	Tue/Thur (Week #7)	Tue/Thur (Week #9)	High-Tech Etch-a-sketch
Lab #6	Tue/Thur (Week #9)	Tue/Thur (Week #10)	Interrupt Driven I/O
Lab #7	Tue/Thur (Week #10)	Tue/Thur (Week #11)	Serial RF-Communication

Exam Schedule

There will be a Midterm and a Final Exam. The following is the exam and quiz schedule.

Item	Date	Location	Time	Topic
Midterm Exam	Oct 24th	TBA	19:00	Topics on Weeks #1 upto #6
Final Exam	Dec 5th	TBA	19:00-21:00	Topics on Weeks #1 upto #12

Evaluation

- It is important to note that the midterm and final exams will be based on the assignment problems, so it is definitely in your interest to seriously attempt to do them all **alone**.
- You will save much time if you thoroughly study the relevant sections of the lab handouts before attempting the experiments in the lab. Come to the lab with a clear understanding of what you are meant to accomplish, or with clear questions, so that the teaching assistant can help you.

Topic	Weight	Date	Details
Labs	35%	See Lab Table	7 Lab Component
Midterm Exam	20 %	Oct 24th	Covers Week 1-6
Final Exam	45 %	Dec 5th	Covers Week 1-12

- If a student does not write the midterm exam, the percentage weighting will be shifted to the final exam such that the final exam will be worth 65% of the student's final grade.**
- In order to pass the course, students must pass both the laboratory and exam course portions. Students must obtain a grade of 50% or higher on the exam portion of the course in order for the laboratory write-up portion of the course to count towards the final grade. Students must attend and complete all laboratories. If a laboratory is missed due to illness or other extenuating circumstance, arrangements must be made with the teaching assistant to complete a make-up lab.**

Communication

Communication is through (i) Newsgroup, (ii) Email, and Web page.

Academic Misconduct

The policy for this course is zero tolerance for any form of academic misconduct. Consultation with other students is encouraged especially on design issues. However, directly copying another student's work or copying portions of code (for example assembly language code) is an honor code violation and will result in a failing grade and may result in a failing grade in the course. Students will automatically be referred to the Director of the School for action. **Please refer to the regulations outlined in the student handbook regarding academic misconduct.**

Safety

To ensure your safety and the safety of others, please abide by the lab safety regulations. The lab coordinator will explain them to you during first lab session.

Disclaimer

The instructor reserves the right to change any or all of the above in the event of appropriate circumstance, subject to University of Guelph Academic Regulations.

Course Road-map

ENG364 "Microcomputer Interfacing" will teach you several concepts relevant to embedded computer systems. This course strives to expose underlying concepts that can be learned today and applied later in practice.

