

ENG 364: Microcomputer Interfacing  
 School of Engineering  
 University of Guelph  
 05-364  
 Fall 2008

## Course Outline

## Instructor

Prof: Shawki Areibi  
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 Office Hours: Fridays, 12:00-13:00

## Lab Coordinator & Teaching Assistants

Lab Coordinator	Teaching Assistant
Nate Groendyk Room 2308, ext. 53873 groendyk@uoguelph.ca	Wilson Harron Room (312), ext 52420 wharron@uoguelph.ca

## Lecture & Lab Schedule

	Lectures	Day	Section	Time	Place
		Mon	-	10:30-11:20	MACK 305
		Wed	-	10:30-11:20	MACK 305
		Fri	-	10:30-11:20	MACK 305
	Laboratory	Thu	-	8:30-10:20	THRN 2307
	Tutorials	Thu	-	10:30-11:20	MACK 236

## 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 defence, 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 8-Sep 12	Micro-controller Concepts	Chapter 1
#2	Sep 15-Sep 29	Assembly Language Programming	Chapter 2 & 4
#3	Sep 22-Sep 26	Program Development	Chapter 3
#4	Sep 29-Oct 03	Parallel Port Interfaces	Chapter 7
#5	Oct 06-Oct 10	Interrupt Synchronization	Chapter 6
#6	Oct 13-Oct 17	Timing Generation and Measurements	Chapter 8
#7	Oct 20-Oct 24	Analog Interfacing and Data Acquisition	Chapter 10
#8	Oct 27-Oct 31	Data Acquisition Systems	Chapter 10
#9	Nov 03-Nov 07	Serial I/O Devices	Chapter 9
#10	Nov 10-Nov 14	Serial I/O Interfacing	Chapter 9
#11	Nov 17-Nov 21	Busses & Transmission Lines	Chapter 13
#12	Nov 24-Nov 30	Memory Interfacing	Chapter 13

## Assignments

There will be 6 assignments throughout the term. You need to hand in your solutions to the TA during the tutorial. The assignments will be checked by the TA. Solutions will be posted for each assignment on the web page every other week.

Item	Handed In	Due Date	Topic
Assignment #1	(Week #2)	Week #4	HC11/HC12 Programming
Assignment #2	(Week #4)	Week #5	General Interfacing
Assignment #3	(Week #5)	Week #7	Interrupt Driven I/O
Assignment #4	(Week #7)	Week #9	Data Acquisition Systems
Assignment #5	(Week #9)	Week #11	Serial Communications
Assignment #6	(Week #11)	Week #12	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	Thur (Week #2)	-	Equipment in the Lab
Lab #1	Thur (Week #3)	Thur (Week #4)	Introduction to MC68HC11/12
Lab #2	Thur (Week #4)	Thur (Week #5)	Parallel Port Programming
Lab #3	Thur (Week #5)	Thur (Week #6)	Keypad and LCD Interfacing
Lab #4	Thur (Week #6)	Thur (Week #8)	Servo Motor Control/Hex Keypad
Lab #5	Thur (Week #8)	Thur (Week #9)	High-Tech Etch-a-sketch
Lab #6	Thur (Week #9)	Thur (Week #10)	Interrupt Driven I/O
Lab #7	Thur (Week #10)	Thur (Week #11)	Serial RF-Communication

## Exam Schedule

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

Item	Date	Location	Time	Topic
Quizzes	Thur	MACK 236	10:30 AM	Material covered in previous weeks
Final Exam	Dec 4th	TBA	7:00 PM	Topics on Weeks #1 upto #12

## Evaluation

- It is important to note that the quizzes and final exam 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	Details	Comments
Assignments	6 %	6 Assignments	Solve all problems and hand in during Tutorial
Quizzes	20 %	5 Quizzes	Topic on material of previous weeks
Labs	24 %	7 Labs	Preparation, Report, questions asked by TA
Final Exam	50 %	6 Questions	Covers Week 1-12

- Five quizzes will be given throughout the term. **If you miss a quiz there will be no makeup.**
- 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 honour 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.

