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ENG 364: Microcomputer Interfacing
School of Engineering
University of Guelph
05-364
Fall 2012

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Course Outline

Prerequisites: ENG2410, ENG2450

Instructor

Prof:	Shawki Areibi
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Office Hours:	Tuesdays, Thursdays, 10:30-11:30

Lab Coordinator

Lab Coordinator
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Teaching Assistants

Teaching Assistant
Omar Ahmed
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Lecture & Lab Schedule

	Day	Section	Time	Place
Lectures	Mon	01/02	10:30-11:20	MACK 226
	Wed	01/02	10:30-11:20	MACK 226
	Fri	01/02	10:30-11:20	MACK 226
Tutorials	Tue	01/02	11:30-12:20	MACK 224
Laboratory	Wed	01	13:30-15:20	THRN 2307
	Wed	01/02	15:30-17:20	THRN 2307

Course Text

1. Huang *HCS12/9S12: An Introduction to "Software and Hardware Interfacing"*, 2nd Edition Delmar, 2012.

References

1. Motorola M68HC11/M68HC12 User Manual.

2. Lecture Notes.

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.

Tentative Schedule

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

Assignments

There will be 8 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. It is in your interest to solve all assignments alone without any help since many questions of the midterm and final exam will be based on these assignments. 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 #3	Assembly Programming
Assignment #2	(Week #3)	Week #4	Cont .. Assembly Programming
Assignment #3	(Week #4)	Week #5	General Interfacing
Assignment #4	(Week #5)	Week #7	Interrupt Driven I/O
Assignment #5	(Week #7)	Week #9	Data Acquisition Systems
Assignment #6	(Week #9)	Week #10	Serial Communications
Assignment #7	(Week #10)	Week #11	Busses
Assignment #8	(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 the Motorola MC68HC12 Micro-controller.

- 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	(Week #2)	-	Introduction to Lab Equipment
Lab #1	(Week #3)	(Week #4)	Introduction to MC68HC11/12
Lab #2	(Week #4)	(Week #5)	Parallel Port Programming
Lab #3	(Week #5)	(Week #6)	Keypad and LCD Interfacing
Lab #4	(Week #6)	(Week #8)	Servo Motor Control/Hex Keypad
Lab #5	(Week #8)	(Week #9)	High-Tech Etch-a-sketch
Lab #6	(Week #9)	(Week #10)	Interrupt Driven I/O
Lab #7	(Week #10)	(Week #11)	Serial RF-Communication

Exam Schedule

Midterms and a Final Exam will be conducted on the dates as shown in the table below. The following is the exam and quiz schedule.

Item	Week	Date	Location	Time	Topic
Midterm	Week #7	TBA	TBA	7:00 PM	Topics on Weeks #1-6
Final Exam	Week #14	11/12/2012	TBA	8:30 AM	Topics on Weeks #1-12

Evaluation

- It is important to note that the midterm and final exam will be based on the assignment problems and labs 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	5 %	8 Assignments	Solve all problems and hand in during Tutorial
Labs	25 %	7 Labs	Preparation, Report, questions asked by TA
Midterm	25 %	5 Questions	Covers Week 1-6
Final Exam	45 %	8 Questions	Covers Week 1-12

i. 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.