ECE 3620 - Introduction to Microcomputers

Fall 2015

Lecture Section: 13741

Lecture times: M & W, 3:30 – 5:00 pm

Lectures for all sections are in Room 160 Manoogian

Final Exam: Friday, December 18 (1:20– 3:50 pm)

Laboratory Sections:
Section 13742 (Tuesdays, 6:00 – 9:00 pm, Room 1013 Manufacturing Bldg.)
TA: Yudi Wei; ek9042@wayne.edu
(TA Office hours: Tuesdays: 3:00-5:00 and by appointment, Room 3321 Engineering)

Section 13743 (Thursdays, 11:45 am – 2:50 pm, Room 1013 Manufacturing Bldg.)
TA: Sina Gholamnejad Davani; fj8461@wayne.edu
(TA Office hours: Thursdays, 3:00-5:00 and by appointment, Room 3352 Engineering)

Prerequisites: BE 1200 and ECE 2610.

WSU Catalog Description (4 cr.) Basics of digital systems, number systems, functional blocks of microcomputers, assembly language and machine code, applications of microcomputers, and experimental demonstrations. Introduction to digital logic.

Prerequisites by Topic: (1) Knowledge of computer systems hardware and software. (2) Programming engineering computations using a high level language. (3) Introduction to the profession of engineering and the design process.

Prerequisites and co-requisites are checked automatically at the time of registration. However, it is ultimately a student's responsibility to make certain that they have the prerequisites and co-requisites for a course. Students must remain registered for a co-requisite course throughout the semester. Advisors will check course prerequisites and co-requisites during the 5th and 6th week of the semester. Any student found to be
registered for a course without meeting these requirements, and without an official waiver on file, will be administratively withdrawn from the course.

**Topics:**
1. Microcomputer Execution of Assembly Programs: A Brief Overview (1 week)
2. Instructions, Addressing Modes, Data Representation, Arithmetic and Logic, Branching, and Simple Assembly Programs (2 weeks)
3. 68HC11 Assembly Programming and Development Tools (2 weeks)
4. Stacks, Subroutines and Data Structures (2 weeks)
5. The Hardware Configuration and Interrupts (1 week)
6. Parallel I/O – Ports B and C (2 weeks)
7. The Analog-to-Digital Converter – Port E (2 weeks)
8. The Timing System and Port A (2 weeks)

**Goals:** The main goal of this one-semester course is to enable students to employ assembly language programming to program a MC68HC11 based microprocessor system to solve engineering problems. This main goal is accomplished by gradually building student knowledge and hands-on programming and testing skills.

**Outcome Coverage:**
(a) *An ability to apply knowledge of mathematics, science, and engineering:* The laboratory experiments, homework exercises and quizzes/final exam require the application of number systems (binary, decimal, hexadecimal etc.) and arithmetic skills to successfully complete the course.
(b) *An ability to design and conduct experiments, as well as to analyze and interpret data:* A major focus of the course is to teach students assembly language programming. In the laboratory sessions, students design and test assembly programs to solve various problems relating to data manipulation and microprocessor interaction with external I/O devices.
(e) *An ability to identify, formulate, and solve engineering problems:* This is achieved by students as they analyze a given problem and write a working assembly program to solve it. Students learn to formulate their understanding of a given problem in the form of a logical sequence of process blocks (flowcharts). They then translate such flowcharts into assembly programs for generating precise solutions.
(k) *An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:* Students learn to use two software simulators: (1) M6800 simulator based on Excel and (2) THRSim11 which is an extensive suite of assembly program development tools for the M68HC11. The students also utilize a powerful evaluation board (EVBplus2) to test their programs by running them on real hardware implementation of the 68HC11.
Learning Objectives: After completing this course, students should be able to do the following:

1. Explain the mechanisms of microcomputer execution of assembly programs at the level of internal registers and MPU/IO/memory interaction.
2. Utilize 68HC11 instructions, addressing modes, data representation, arithmetic and logic in the design of assembly programs in order to solve simple engineering problems.
3. Use microprocessor evaluation board hardware to execute assembly programs and implement basic hardware interfaces with external electronic components.
4. Use stacks, subroutines and data structures as essential building blocks in assembly programs.
5. Explain the hardware configuration and the interrupt system for the 68HC11 microprocessor.
6. Write assembly programs that take advantage of I/O parallel ports B and C, analog-to-Digital converter (Port E) and the timing system (Port A).
7. Use software simulators in the development phase of assembly programs for the purpose of testing and debugging.

Instructor & Course Coordinator Information:
Name: Mohamad H. Hassoun, Professor
Office: 3127 Engineering Building
Office Phone: (313) 577-3966
Email: hassoun@eng.wayne.edu
WWW: http://neuron.eng.wayne.edu/

Office Hours (Room 3127 Engineering):
Mondays: 1:00 – 3:00
Wednesdays: 12:00 – 1:00
And by appointment.


The laboratory manual is available on-line.

Course Structure: The course has a lecture component and a laboratory component.

Laboratory Resources:
1. Wytec EVBplus2 (M68HC11-based) evaluation board and associated electronic components (LEDs, seven segment display, resistors, transistors, etc.)

2. Desktop PCs running Windows (software includes: Microsoft Word, Excel and other standard Microsoft software).

3. Software: M6800 simulator (an Excel-based application written by Dave Conger) and THRSim11: a M68HC11 simulator, assembler, and disassembler for developing, testing and downloading assembly programs to the EVBplus2 board.

**Laboratory Policy:** There is absolutely no smoking, eating or drinking in any ECE instructional laboratory. These labs must be kept neat and each student is responsible for insuring that the equipment on his/her workbench is neatly arranged, that all components and equipment are put away at the end of the session, and that there are no scraps of paper or other garbage left on or near his/her workstation. Coats, briefcases, knapsacks and other personal belongings are not permitted on or near the benches. The door to the lab must be kept locked at all times; unlocking or propping open the door at any time is expressly forbidden. Guests are not permitted in the lab at any time, and no one but the instructor may open the door to admit anyone after the class has begun. Additional laboratory policies may be provided by your TA.

Students may borrow the kits overnight or over the weekend, but only after getting permission from the professor-in-charge of the course. In this case, a student must sign the kit out and be responsible for all its contents. There will be a fee of $200 to the student if he/she damages the microprocessor board (EVB). A student who loses a borrowed kit will be charged $350. The TA is responsible for obtaining a student’s signature (agreeing to the above charges) before he/she could borrow a kit. A borrowed kit must be returned to the next scheduled laboratory session and its contents inventoried by the TA.

**Grading:**

Lecture Section: 85%
Lab Section: 15%

Lecture Section Point Distribution:
Homework: (Homework Policy)
Quizzes: 70%
Final Exam: 30%

**Lab Section Point Distribution:**

The 15 laboratory points that a student can earn are broken down as follows (each point corresponds to one percent of the total possible score for the course:...
- **Attendance**: 2 points
- **Organization** (handling of the kit components, restoring the kit to its original form at the end of each experiment, neatness, etc.): 1 point
- **Active participation** in conducting the experiments: 2 points
- **Reports**: 10 points

**Total**: 15 points

**Grading Scale:**

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<th>Percentage/Grade/(Honor Point Value)</th>
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<tbody>
<tr>
<td>95-100 A (4.00)</td>
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<tr>
<td>90-94 A- (3.67)</td>
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<tr>
<td>85-89 B+ (3.33)</td>
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<td>80-84 B (3.00)</td>
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**Attendance**: Attendance is mandatory for all lectures and lab sessions. A student will lose 2 points (out of 15) for each unexcused missed lab (and the lab experiment must still be completed as arranged by the TA), and 1 percent (out of the total final score) for every unexcused absence from lectures.

A grade of I will be available only if the student needs to complete at most the final exam.

There will be a quiz for 10 – 30 minutes every week at the beginning of one of the lecture sessions.

The final exam is scheduled according to the published university final exam schedule.

**Makeup Exam and Makeup Assignment Policy**: No make up quizzes. A student may miss up to 2 quizzes without affecting your grade; missing two quizzes means that a student’s total quiz score is to be determined by the remaining 10 quizzes.

Laboratory makeup is only allowed in cases of documented emergencies. The TA will determine a suitable time for such makeup.
**Homework Policy:**
- The homework will not directly count towards the final grade of the lecture part of the course.
- You still have the option of turning in your homework to your instructor for documentation purposes.
- Answers to selected assigned homework problems will be posted on the course web page.
- Students are encouraged to work on the homework in groups of two or three.
- So why should I (the student) bother about the homework? Answer: Because it is the best way to practice for the quizzes. And quizzes count for 70% of the lecture grade! So make sure to take the assigned homework problems seriously.

**Students with Disability:** If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

**Cheating and Penalty for Cheating:** Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment or exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure “Academic Integrity,” will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course.