ECE 2620 - Introduction to Microcomputers

Fall 2006

Class Start/END Dates: 9/5/06-12/13/06

Lecture times: M & W, 7:30 – 9:20 pm

Lectures for all sections are in Room 224 State Hall

Laboratory Sections:

10275 (Wed., 8:30-11:30, Room 1013, Manuf.) Victor Bondarenko
(ai8868@wayne.edu)

11793 (Th., 11:45-2:50, Room 1013, Manuf.) Iyad Jafar
(au5172@wayne.edu)

12082 (Tues., 6pm- 8:50, Room 1013, Manuf.) Yanging Ji
(ak3167@wayne.edu)

Prerequisites: BE 1200.

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.

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.

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 assembly program in order to solve simple engineering problems.
3. Use a 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 takes 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
Abhilash Pandya, Asst. Professor.
Office: 3129 Engineering Building
Office Phone: 313 577-9921
Email: apandya@ece.eng.wayne.edu
Office Hours: T/Th 3-4

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: by appointment.


Prerequisites by Topic: (BE 1200) (1) Engineering 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.

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)

Course Structure: The course has a lecture component and a laboratory component. The lecture is twice a week for 1hr and 50 min each lecture. The laboratory is once a week and lasts for 3 hours.

Laboratory Resources:

1. Wytec EVBplus2 (M68HC11-based) evaluation board and associated electronic components (LEDs, servo motor, resistors, transistors, etc.)
2. Desktop PCs running Windows XP (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, 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 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.

Student teams 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, the students must sign the kits 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 checked by the TA.

**Grading:**
Lecture Section: 75%
Lab Section: 25%

**Lecture Section Point Distribution:**
Homework: 00% *(Homework Policy)*
Quizzes: 70%
Final Exam: 30%

**Lab Section Point Distribution:**
The 25 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 points
- **Active participation** in conducting the experiments: 2 points
- **Reports:** 20 points
  **Total:** 25 points

**Grading Scale:**
Percentage/Grade/(Honor Point Value)
95-100 A (4.00)
90-94 A- (3.67)
85-89 B+ (3.33)
80-84 B (3.00)
75-79 B- (2.67)
70-74 C+ (2.33)
65-69 C (2.00)
60-64 C- (1.67)
55-59 D+ (1.33)
50-54 D (1.00)
45-49 D- (0.67)
0-44 E (0.00)

**Attendance:** Attendance is required for all lectures and lab sessions. Students who do not complete the coursework, but fail to officially withdraw from the course will receive an E or X depending on how much coursework has been completed. A grade of I will be available only if the student needs to complete at most the final exam.
**Schedule:** In accordance with the University policy on Early Progress Assessment, at least one quiz will be given before the end of the fourth week of classes and will be graded and returned before the end of the fifth week of classes. The grades for these quizzes will be used to determine student performance during the Early Progress Assessment period.

There will be a quiz for 10 – 20 minutes every week at the beginning of the lab sessions.

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

The last day to drop any class with a tuition refund is the end of the second week of classes. The last day to withdraw from the class, without a notation of W on the transcript, is the end of the fourth week of classes. It is the policy of the College of Engineering not to allow withdrawals from courses after the end of the 5th week except under exceptional circumstances.

**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.

**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 devises.
(c) *An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability:* Students work in the laboratory in teams of three students to design assembly code to solve specific problems. The code written is constrained by the hardware (microprocessor system) that runs such code. Memory saving and execution time are practical
constraints that must be met in designing assembly code for critical applications in automotive control and other application areas. Students go through several iterations of refining and debugging their initial code before they are able to arrive at working designs (programs).

(d) An ability to function on multi-disciplinary teams: As mentioned in (c) above, students work in teams of three students each in the laboratory. Organization and active contribution to team effort is stressed and affects the final grade.

(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.

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.

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 Webpage.
- 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 problems seriously.