ECE 5630 Syllabus, Fall 2005

No: ECE 5630

Title: Microcomputer Laboratory. Cr. 2 (LCT: 1; LAB: 3)

WSU Catalog Description:
Prereq: ECE 4340, 4600. Study of microcontroller architecture, timers, interrupt structures, analog-to-digital converters and capture and compare modules. Testing and evaluation of microprocessor based systems. Design and development of complete microprocessor based digital systems. Material fee as indicated in the Schedule of Classes. (T)

Coordinator: Dr. Syed Masud Mahmud, Associate Professor of Electrical and Computer Engineering.

Instructor: Wanli Chen, Graduate Teaching Assistant, Electrical and Computer Engineering Department.

Office Hours: 5:00-7:00 Friday
Office Location: 3114 Engineering Building
Phone: 313-577-1340 Email: am1905@wayne.edu
Course Meeting Time: 12:50 – 5:00 Friday
Course Meeting Location: 1013 Manu

Goals: To develop competence in analysis, design, testing and troubleshooting of microprocessor based digital systems. To prepare students for better job opportunities in the area of embedded system design.

Learning Objectives: After completing this course, students should be able to do the following:

1. Write assembly language programs for PIC16 family microcontrollers for various applications.
2. Use MPLAB software for developing and debugging assembly language programs.
3. Use timers of PIC microcontrollers for various types of time measurements.
4. Write interrupt service routines for PIC microcontrollers.
5. Use capture and compare features of the PIC microcontrollers.
6. Use analog to digital converter to measure external analog signals.


Reference Texts: none

Prerequisites by Topic: (ECE4600) Digital logic, assembly language, parallel and serial I/O.

Corequisites by Topic: none

Topics:

1. Week 1: Introduction to Microcomputer Lab
2. Week 2: Lecture on PIC Micro controllers
3. Week 3: Lecture on PIC Micro controllers
4. Week 4: Lecture on PIC Micro controllers
5. Week5: Getting used to MPLAB
6. Week6: Using timers
7. Week7: Using interrupts
8. Week8: Using LCD
9. Week9: Capture & compare control
10. Week10: Analog to digital conversion
11. Week11+: Final project

Course Structure: The course has only one 4-hour long session per week. The class is divided into a number of groups and each group contains 2 to 3 students. For the first four weeks the students attend lectures and for the rest of the semesters the students work on their laboratory and project assignments.

Computer Resources: Windows XP PC with MPLAB Software

Laboratory Resources: http://cic.eng.wayne.edu/~cwl/ http://www.microchip.com

Laboratory Policy: There is absolutely no smoking: eating or drinking in any ECE instructional lab. 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 the leads and other equipment are put away, and that there are no scraps of paper or other garbage left on or near his/her work station. Coats, briefcases: Knapsacks and other personal belongings are not permitted on or near the benches. These items must be kept on the coat rack near the door, not on the benches, window sills or the floor 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. (For further laboratory policies, please look at the laboratory manual.)

Distribution of Points:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Lab Performance</td>
<td>10%</td>
</tr>
<tr>
<td>Attendance</td>
<td>10%</td>
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<tr>
<td>Quiz</td>
<td>15%</td>
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<tr>
<td>Lab Report</td>
<td>30%</td>
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<tr>
<td>Final Project</td>
<td>35%</td>
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</tbody>
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Grading Scale: Percentage Grade (Honor Point Value)

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<thead>
<tr>
<th>Grade</th>
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<tbody>
<tr>
<td>95-100</td>
<td>A (4.00)</td>
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<tr>
<td>90-94</td>
<td>A- (3.67)</td>
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<td>85-89</td>
<td>B+ (3.33)</td>
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<tr>
<td>80-84</td>
<td>B (3.00)</td>
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<td>75-79</td>
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<td>70-74</td>
<td>C+ (2.33)</td>
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<tr>
<td>65-69</td>
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<td>60-64</td>
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<tr>
<td>55-59</td>
<td>D+ (1.33)</td>
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<td>45-49</td>
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<td>0-44</td>
<td>E (0.00)</td>
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Attendance: You are expected to attend every lab session in its entirety. Do not schedule other classes
or commitments that conflict with any part of the time during which your lab section is scheduled. Attendance is recorded and will be used in determining your grade. For each lab session you miss, two (2) points (out of hundred points) will be deducted from your FINAL LAB AVERAGE. In no case will a lab report be accepted for a section for which you were not present. Doing the experiment in another session is expressly forbidden. You may not use another section to "make up" a section for which you were absent. Since arriving late and leaving early are disruptive to the lab, 1/2 point (out of 100 points) will be deducted from your FINAL LAB AVERAGE for each occurrence. Admittance to the lab will begin about 10 minutes before the scheduled starting time and it is suggested that you plan to arrive at least 10 minutes early to facilitate your inventory, and to avoid losing point for being late.

**Schedule:** Lectures during the first three weeks and labs during the rest of the semester. Quiz will be given on the 5th week. Project in the last 3-4 weeks.

**Makeup Exam and Makeup Assignment Policy:** No make up exam will be given unless you have an undeniable cause.

**Outcome Coverage:**

(a) An ability to apply math, science and engineering knowledge. The laboratory exercises, quizzes and exams require direct application of mathematical, scientific, and engineering knowledge to successfully complete the course. This requires performing various digital and analog circuit analysis methods in a formal manner and many supporting and follow-up calculations.

(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 microcontroller based embedded systems. In the laboratory sessions, students design and test various systems relating to data manipulation, interaction with external devices via parallel I/O lines, and collection of data from external devices via analog to digital converter. Students conduct simple experiments using microcontrollers and off-the-shelf analog and digital integrated chips.

(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. The laboratory assignments involve the design of various real-time embedded systems which is constrained by the type of processor, the clock frequency of the process, number of digital I/O pins, number of analog channels, the size of analog-to-digital converter and the amount RAM and ROM available within the system. 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 area. 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: Students work or their design projects in teams of three students. The project work involves the design of electronic controllers, automated vehicles, voice activated devices and many other types of systems that are multi-disciplinary types. Organization and active contribution to team effort is required in the course.

(e) Identify, formulate and solve engineering problems. The students achieve this item as they analyze a given problem, write a working assembly program and construct a working hardware to solve the problem. 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 and hardware modules for generating precise solutions.

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering
practice: Students learn to use the MPLAB software, a modern tool developed by Microchip.

Cheating Policy 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.

Prepared By: Syed Masud Mahmud, Associate Professor of Electrical and Computer Engineering

Last Revised: September 5, 2005