ECE 4510 Microcontroller Applications, Summer I 2011

WMU Catalog:	Hardware and software design of real-time embedded microcontroller systems.. Credit: 4 hours A required course for computer engineering and an elective course for electrical engineering. Prerequisites: ECE 2210, ECE 2510. Recommended Prerequisites: ECE 3550, ECE 3570
Class Schedule:	MWF 1:30-3:20 PM, CEAS C-124
Instructor:	Dr. Bradley J. Bazuin, Associate Professor, ECE CEAS A-241 brad.bazuin@wmich.edu http://homepages.wmich.edu/~bazuinb/
Required Textbook and Materials:	1. Han-Way Huang, The HCS12/9S12: An Introduction to Software and Hardware Interfacing, 2nd ed., Thompson, 2010, ISBN # 1-4354-2742-4 2. Adapt9S12DP512 Evaluation Board by Technological Arts 3. ECE 4510 Parts Kit and Solderless Breadboard 4. ICC12 IDE software by ImageCraft 5. USB Memory stick
Supplied Materials:	1. CPU12 Reference manual, Motorola/Freescale 2. MC9S12DP256B Device User, Motorola/Freescale 3. Materials disseminated using the ECE 4510/ECE5530 Class Web Page (the official media for the class). They include the Instructor's Lecture Notes.
Recommended Textbooks/Materials:	1. The C Programming Language, 2nd ed., B.W. Kernighan and D.M. Ritchie, Prentice Hall, 1988. ISBN: 0-13-110362-8. 2. Jean L. Labrosse, MicroC/OS – II The Real Time Kernel, 2nd ed., CMP Books, ISBN 1-57820-103-9 3. Jonathan W. Valvano, Introduction to Embedded Systems: Interfacing to the Freescale 9S12, Cengage Learning, 2010, ISBN 978-0-495-41137-6

Prerequisites by Topic:

1. Basic level digital logic design
2. Basic level analog circuit design
3. Assembly and C language programming (sequential C vs. object oriented)

Course Topics (Expected):

1. Introduction to the Motorola HC12/HS12 Microcontroller Families
2. MC9S12DP512 Architecture and Memory Map
3. CPU12 Programmer's Model and Basic Assembly Language Programming
4. C Programming with the ICC12 IDE Environment
5. uC/OS-II Real-Time Kernel Concepts
6. Interfacing to the Parallel I/O Ports
7. Programming the Flash Memory
8. Interrupts
9. Programming the Timer Module
10. Input Capture and Output Compare
11. Programming the PWM Module
12. Analog Input and Output Interface
13. Serial Communications Interface
14. SPI Interface
15. CAN Interface
16. Design of Static Memory Systems
17. Interfacing Static Memory to the MC9S12DP512 External Bus
18. 8 or 16-Bit Memory Modules, Critical Timing Analysis

Course Objectives:

This course develops (objectives include listing of relevant ECE Department undergraduate learning outcomes)

1. To provide experience to design digital and analog hardware interface for microcontroller-based systems (a, b, c, e).
2. To provide experience to integrate hardware and software for microcontroller applications systems (k).
3. To provide experience to debug a microcontroller-based system and to analyze its performance using advanced debug tools and electronic test instrumentation (b, k).
4. To provide experience develop, run, and experimentally validate code written in a high-level language for a microcontroller system (b, k).
5. To develop skills to prepare effective written technical communications for engineering analysis and design work through project reports (g)
6. To provide experience to work in a multi-disciplinary team (d)
7. To assess the students' ability to design, conduct experiments, and interpret data (b)
8. To assess the students' ability to function in a multi-disciplinary team (d).
9. To assess the students' skills to use modern tools of engineering practice (k)

Laboratory Work:

The platform in the lab is the Adapt9S12DP512 Board by Technological Arts. Programs will be created, compiled, and downloaded to the board using the ICC12 IDE environment, D-Bug12 debug Monitor that has been preloaded in the flash memory of the microcontroller on the Adapt board, and NoICE Debugger by NOICE.

We will be using standard scientific/engineering procedure regarding laboratory reports. This means that you are expected to come to class prepared. Prelab and Lab Assignments will be posted on the Class Web Page. The objective and design sections (the latter contains pseudocode of software, circuit schematic diagrams, timing diagrams, math formulas, etc.) of your lab report should be completed before lab as a draft. The finalized design, data/results and conclusion sections of the Team's Lab Report should be completed either during the lab session, or shortly thereafter. In the conclusion section you will describe major concepts observed/discovered, discuss any anomalies and suggest what caused them.

Prelab Assignments will be checked by the lab instructor at the beginning of each lab. Missing, or insufficient Prelabs will be penalized by losing 3 pts (out of 12 pts) for the lab. Lab reports may be done in pencil but typed reports using a word processor are

highly recommended. The penalty will be severe for illegible writing, sloppy schematics and drawings.

Lab reports are due at the beginning of the next scheduled lab session. Late reports may result in a grade 0 pts for the lab. Lab reports should be handed directly to the lab instructor.

If you don't show up for a lab, you forfeit the points associated with it and cannot later make up the lab. Exceptions will be made only for those individuals who contact their lab instructor before the lab and have an excused absence.

There will be a Lab Final (worth three regular labs, 36 pts.).

Note: You must achieve a passing grade in the lab (total 60% out of 100% of lab points) in order to pass the class. If you complete all course requirements and do not pass the lab portion of the course, a grade of E will be given.

Plagiarism and/or the copying/duplication of another student's, or team's designs or written reports will result in a zero scores for the lab.

Open Lab Hours:

Extended Lab Hours will be posted on the Lab Door and Class Home Page. Students are advised to use the Lab's resources, as well as their own boards, parts and software when the lab is closed to complete their lab reports, prepare for the next lab, and work on homework assignments and the design project.

Laboratory Design Project:

A Lab Design Project will be assigned to control a model of a technological process, and will be done using the Parts Kit and equipment readily available in the lab. Projects will be carried on in teams of two students, or may be worked on individually. The demonstration of the projects working correctly will be worth up to 40% of the credit assigned.

Late projects will be accepted up to five days after due date (not after the Lab Final Exam, though) but will be penalized by -10% for each day that is tardy! Failure to work on or submit the project will result in an X grade for the course.

Homework:

Homework will be assigned on a regular basis. It will be due on the date specified, typically one to two class periods after the assignment. Homework assignments and the expected due dates are posted on the class web site. Late homework will not be accepted. It is your responsibility to get the assignments and complete them.

Quizzes:

There may be a few pop quizzes. Quizzes will count as part of the homework grade. All quizzes are closed book and closed notes. They will be 10-15 minutes in length, typically at the beginning of the class period. If you miss a quiz, it cannot be made up and you will not receive credit for the points.

Exams:

There will be one midterm exams and a two-hour final exam. The midterm exam will consist of a 1 hour in-class exam. The midterm exam is tentatively scheduled for Friday, 3 June.

The Final Exam will consist of a 2 hour in-class exam. The in-class exam will be on Wednesday, 29 June from 1:30 PM to 3:20 PM.

Students are required to attend all in-class exams as schedule; failure to do so may result in an X grade for the course.

Grading Policy:

Grades will be determined on the following basis:

Homework Submission –	10 % (10% x # of HW Attempted/Total Problems)
Lab –	35 % (a grade of 60% is required to pass the course)
Laboratory Project	10%
Midterm Exam –	15 %
Final Exam –	30 %

The class performance distribution will be taken into account for assigning letter grades.

Permission to miss any due date may be granted by the instructor under extreme circumstances. If permission is desired, a request must be made before the due date and should include either a signed doctor's explanation or a written explanation signed by an appropriate WMU officer.

Codes, Policies, Processes and Procedures:

WMU STUDENT ACADEMIC CONDUCT POLICY

You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at http://catalog.wmich.edu/ under Academic Policies, Student Rights and Responsibilities, Student Academic Conduct.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you

will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

The WMU College of Engineering and Applied Sciences Honesty Code will also apply in this course.

Finally, students are encouraged to visit to http://osc.wmich.edu and/or http://www.wmich.edu/registrar to access the Code of Honor and general academic policies on such issues as diversity, religious observance, student disabilities and other topics.

Prepared by: Bradley J. Bazuin Date: 9 May 2011