

Department of Electrical and Computer Engineering
University of Wisconsin-Madison

ECE 353
INTRODUCTION TO MICROPROCESSOR
SYSTEMS

Syllabus and Policies

Spring 2009

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<u>CREDITS:</u>	3
<u>PREREQUISITES:</u>	ECE/CS 352, ECE/CS 354
<u>GOALS:</u>	This course focuses on the construction of microprocessor based systems from off-the-shelf components. The emphasis is on building microprocessor-based systems through the interfacing of commercially available devices. At the end of the course, it is expected that you will be able to design a microprocessor-based system with confidence.
<u>TOPICS:</u>	Microprocessor System Design Process Hardware and Software Development Tools Introduction to the ARM Microprocessors ARM7TDMI Organization Instruction Set, Addressing Modes Stack, Branching, Subroutines Microprocessor Support Circuits and Peripherals Parallel Interfacing and Timing Memory Systems Interrupts and Exceptions Switches, Keypads, and Displays Serial Interfacing Analog Signals
<u>TEXTBOOK:</u>	F.M. Cady, <i>Microcontrollers and Microcomputers</i> , Oxford Press, 1997 Materials posted on the course web page
<u>GRADING POLICY:</u>	5% Pre-quizzes and other individual assignments 25% Homework 45% Midterm quizzes (3) 25% Final exam

COURSE CONDUCT

TIMETABLE

Lecture: 9:55am, MWF
Location: 2535 Engineering Hall

Discussion: 6:30-8:00pm, Wednesdays, 3534 Engineering Hall

INSTRUCTOR

Name: Eric Hoffman (erichoffman@wisc.edu)
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TEACHING ASSISTANT

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<http://webpages.cae.wisc.edu/~ehoffman/ece353.html>

REQUIRED TEXT / MATERIAL

- F.M. Cady, *Microcontrollers and Microcomputers*, Oxford Press, 1997
- Supplementary material published online

REFERENCE TEXTS

- Numerous references are posted in electronic form on the course web page
 - ARM Architecture Reference Manual (ARM)
 - ARM7TDMI Technical Reference Manual (ARM)
 - ADuC7026 Datasheet (Analog Devices)
 - ARM7 Instruction Set Reference (Morrow)
 - ARM7 Instruction Set Quick Reference (Morrow)
- Steve Furber, *ARM System-on-Chip Architecture*, Addison-Wesley, 2000
- M.M. Mano & C.R. Kime, *Logic and Computer Design Fundamentals*, 4th Edition, Prentice Hall, Inc., 2008

COURSE ORGANIZATION

The course is organized into seven modules, each two weeks in length. Each module will have an associated homework assignment, and an exam will be given after every two modules. Each student will be assigned to a 3-person team, and will complete all homework and in-class activities as part of this team. Teams will be assigned at the start of the semester, and will remain in place for the entire semester. Each team will prepare and submit a contract outlining their responsibilities to each other. Details of team organization and responsibilities will be presented on the first day of class.

Learn@UW will be used for a number of purposes, including administering pre-quizzes and providing students with online access to their grades. A link to the *Learn@UW* entry page is available on the course web page. Email will be used extensively to communicate with the class. Students should verify that their UW email information is correct, and check their email at least daily during the course.

STUDENT RESPONSIBILITY

You are responsible for all assigned reading material in the text and notes, and all lecture content unless otherwise specified by the instructor. If you miss class, it is your responsibility to obtain assignments and other information given on the days you missed.

Unless otherwise specified, your work in this course is to be your own. In particular, the use of software including script written wholly or partially by other students is specifically prohibited.

USE OF COMPUTER-AIDED ENGINEERING CENTER (CAE)

There will be extensive homework assignments requiring the use of programs on PCs in the Computer-Aided Engineering Center. Brief introductory sessions to CAE systems are provided by CAE early in the semester. Mandatory tutorial sessions will be held early in the semester to familiarize you with the Keil μ Vision3 integrated development environment (IDE) that we will be using for software development.

HOMEWORK

Homework shall be accomplished by students working in 3-person teams. Each assignment will be given a single grade for all team members. Team self-assessment will be used to determine an overall weighting factor for individual members of the team. Seven homework sets will be assigned during the semester. These should be neatly done on 8½ by 11 sheets with all pages stapled together in order. Computer output must be properly formatted and annotated with comments, per the Documentation Standards included in the course notes. All diagrams shall be drawn using Mentor Graphics or other tools capable of generating high quality logic diagrams. Homework assignments tend to build on one another throughout the semester; therefore it is essential to complete each one. If you do not have a fully functional assignment on the day it is due, turn in what you have and continue to work on the assignment.

All homework that you submit in this course is expected to be the product of only your team. Evidence indicating copying of work from others outside your team or other inappropriate cooperation will be dealt with as academic misconduct. Acceptable types of assistance you may receive from (or offer to) others outside your team are limited to assisting in problem interpretation, and occasional general hints on ways of attacking a problem. If in doubt, see the instructor or teaching assistant.

Homework assignments are due at the **beginning** of class on the date specified for submission. After this deadline, no credit will be given except under extreme non-academic circumstances. Both the instructor and teaching assistant have office hours for discussing questions on the homework and other course subjects; appointments can be made for other times, with e-mail recommended to contact either. *The teaching assistant has primary responsibility for questions on the software tools.*

Any issues with homework grading must be resolved with the TA or instructor within one week of the day that the graded homework is returned.

PRE-QUIZZES AND IN-CLASS QUIZZES

There will be a number of very short pre-quizzes that will be completed online using Learn@UW. These will cover basic material from the assigned reading. These pre-quizzes must be completed within a window of time that will be announced for each one. Additionally, short quizzes may be given at any time during class.

QUIZZES AND EXAMINATIONS

There will be three quizzes and a final exam. These will be closed-book except for the use of one **3x5 card** (both sides may be written on) containing your own *original, handwritten* notes. The final exam will be comprehensive. Make-up tests will only be given in the most extreme of circumstances.

Test questions will be based on material from the text, notes in class, homework, datasheets, and other problems covered in the discussion sessions. A list of educational objectives will be posted on the course web page, and will be the basis for the development of test questions. When the use of datasheets or the microprocessor instruction set is required, they will be supplied for your use during the exam.

GRADING

Partial credit will be given when appropriate, depending on the nature of the question. Thus, in the same test, some questions will likely be graded on an all-or-nothing basis and others on a partial credit basis.

The grade weighting was specified previously. Any question about the grading of an examination paper must be submitted to the instructor within two days following the return of papers to the class. It is your responsibility to pick up your midterm examination papers promptly.

DISCUSSION SESSIONS AND CONSULTATIONS

It is strongly recommended that you attend the discussion section. The discussion section will typically focus on solving example problems that reinforce the lecture material. A schedule will be posted on the course web page.

If you have further questions on course material or related topics, both the instructor and teaching assistant are available for consultation as discussed previously. Seek assistance before minor questions become major problems. Of course, it's always better to get your questions answered before a test than afterwards. ***Your constructive comments and suggestions on how the course could be improved are always welcomed, and are your opportunity to make the class more interesting and useful to you and future students.***

Office hours will be announced early in the semester.

TENTATIVE COURSE OUTLINE

Module	Week #	Week Start	# of Lec	Topic(s)	Readings
1	1	1/21	2	Course Introduction Microprocessor System Design	Ch. 1
	2	1/27	3	Microprocessor Organization ARM Microprocessors	Ch. 2-3 AARM Preface, Ch. 1 ARM7 Ch. 1
2	3	2/2	3	Development Tools and Environments ARM7TDMI Organization *** <i>Development Tool Tutorials</i> ***	Ch. 5, 6.1-6.11, 6.14 ARM7 Ch. 2 Supplement #1
	4	2/9	3	Addressing Modes ARM7TDMI Instruction Set	Ch. 4 ARMINSTREF
3	5	2/16	3	Assembly Language Programming Stacks and Subroutines	Ch. 6.12-6.13
	6	2/23	3	Assembly Language Programming Quiz #1 (<i>covers Modules 1 & 2</i>)	
4	7	3/2	3	Microprocessor Support Circuits I/O Subsystems	Ch. 7.1-7.4 ADUC 51-52,60-61,84-85 Supplement #2
	8	3/9	3	Microprocessor Peripheral Devices Introduction to the ADuC7026 * Spring Break Follows this *	ADUC p. 53-60, 71-73, 75-79

Module	Week #	Start	# of Lec	Topic(s)	Readings
5	9	3/23	3	Memory Technologies & Devices Memory System Design	Ch. 7.5, 9 ADUC p. 9-10, 33-36, 43-47, 79-82
	10	3/30	3	Memory Interfacing Asynchronous Bus Timing Analysis Quiz #2 (<i>covers Modules 3 & 4</i>)	Supplement #3 Review Ch. 9
6	11	4/6	3	Interrupts and Exceptions	Ch. 8 ADUC p. 74-75 ARM7 2.8-2.10
	12	4/13	3	Switches, Keypads, and Displays	Ch. 7.6-7.10 Supplement #5
7	13	4/20	2	Serial I/O	Ch. 10 ADUC p. 62-71 Supplement #4
	14	4/27	3	Analog signals	Ch. 11 ADUC p. 30, 37-42, 48-49
	15	5/4	3	Catch-up, review and critiques	
				Final Exam – Monday, 5/11 at 2:45am (Over entire course)	