

Fall 2003  
ECE 438  
Tu/Th 11:00am - 12:15pm  
Classroom: ECE Room 210

## **ECE 438: Computer Design**

<http://www.ece.unm.edu/~dbader/ece438/>

**Instructor:** Dr. David A. Bader, ECE 230B, 277-6724, [dbader@ece.unm.edu](mailto:dbader@ece.unm.edu)

**Course Assistant:** Vikas Chaudhary, [vikas@unm.edu](mailto:vikas@unm.edu)

**Office Hours:** Tuesday/Thursday 10:00-10:45AM, or by appointment

**Textbook:** Hennessy and Patterson,

*Computer Organization and Design: The Hardware/Software Interface, Second edition*

**Course Description:** Computer architecture; design and implementation at HDL level; ALU, exception handling and interrupts; addressing; memory; speed issues; pipelining; microprogramming; introduction to distributed and parallel processing; buses; bus protocols, and bus masters. CAD project to include written and oral presentations.

Prerequisites: Electronics I and II, Computer Architecture and Organization, Microprocessors, and Intermediate Logic Design.

### **Grading:**

(20 %) Exam I  
(20 %) Exam II  
(25 %) Final  
(20 %) Design Project  
(10 %) Homework  
( 5 %) Class participation

## **CLASS GOALS**

This course will give you an in-depth understanding of the inner-workings of modern digital computer systems and tradeoffs present at the hardware–software interface. You will get an understanding of the design process in the context of a complex hardware system, gain practical experience with computer-aided design tools, and learn how to work in groups.

## CLASS POLICIES

1. Class announcements will be sent to the **ECE438** mailing list. To subscribe, visit:  
<http://www.ece.unm.edu/mailman/listinfo/ece438/>.
2. **Homework.** There will be approximately eight (8) homework assignments. You may discuss homework problems in depth with your colleagues, but must turn in your own work. Homework is due by 11am on the due date, and placed in the 438 mailbox. No late homework will be accepted.
3. **Exams.** Exams I, II, and Final will be in-class, closed-book exams. You will be allowed to take a “cheat sheet” (double-sided 8.5 x 11 sheet of paper) into each exam. The final exam is scheduled for Tuesday, December 16th, from 10am - 12pm.
4. Please let me know as soon as possible if you will need to re-schedule an exam, or have any special needs during the semester.

## Tentative Course Schedule

Week	Date	Lec	Topic	Assignment
1	26 Aug	1	Introduction, Components of a Computer	Ch. 1
	28 Aug	2	Performance and Cost	Ch. 2
2	02 Sep	3	Instruction Set Design / MIPS ISA Review	Ch. 3
	04 Sep	4	Technology, Delay Modeling	
3	09 Sep	5	SPIM: a MIPS simulator	
	11 Sep	6	ALU Design for Addition and Subtraction	Ch. 4.1-3
4	16 Sep	7	Logical Operations, Multiply, Divide	Ch. 4.4-7
	18 Sep	8	FP Numbers, Pentium Bug	Ch. 4.8-14
5	23 Sep	9	Designing a Single Cycle Datapath	Ch. 5.1-3
	25 Sep	10	<b>Exam I</b>	
6	30 Sep	11	Designing a Multiple Cycle Datapath	Ch. 5.4
	02 Oct	12	Designing a Multiple Cycle Controller	Ap. C
7	07 Oct	13	Designing a Multiple Cycle Controller	Ch. 5.5-12
	09 Oct	14	Microprogramming and Exceptions	
8	14 Oct	15	Introduction to Pipelining	Ch. 6.1-3
	16 Oct	-	<i>Fall Break</i>	
9	21 Oct	16	Pipeline Hazards and Solutions	Ch. 6.4-14
	23 Oct	17	Data Hazards and Stalls, Branch Hazards	
10	28 Oct	18	Exceptions, Superscalar and Dynamic Pipelining	
	30 Oct	19	Introduction to Memory System Design	Ch. 7
11	04 Nov	20	<b>Exam II</b>	
	06 Nov	21	Cache System Design	Ch. 7.2-3
12	11 Nov	22	Measuring and Improving Cache Performance	
	13 Nov	23	Virtual Memory	Ch. 7.4-11
13	18 Nov	24	I/O Devices and Systems / Buses and OS's Responsibility	Ch. 8
	20 Nov	25	Interfacing I/O Devices to Memory, Processors, and OS	
14	25 Nov	26	Instruction Level Parallelism (VLIW / Superscalar)	
	27 Nov	27	<i>Thanksgiving Holiday</i>	
15	02 Dec	28	Introduction to Multiprocessors	Ch. 9
	04 Dec	29	Multiprocessors Connected by a Single Bus	
16	09 Dec	30	Multiprocessors Connected by a Single Network	
	11 Dec	31	Advanced High-End Computing Systems	
17	16 Dec	-	<b>Final Exam</b> (10am-12pm)	

# COMPUTER ACCOUNTS

During this course you will need to use the SPIM MIPS R2000/R3000 Simulator which is available from <http://www.cs.wisc.edu/~larus/spim.html>. The current release of SPIM is version 6.5, and versions are available for UNIX and Windows. To compile and run *spim* and the X11 interface *xspim* on the department's Sun workstations, use a secure shell session to `solaris.ece.unm.edu` and issue the following commands:

```
% wget http://www.cs.wisc.edu/~larus/SPIM/spim.tar.gz
% gzcata spim.tar.gz | tar xvf -
% cd spim-6.5
% ./Configure
% xmkmf
% make
% make xspim
% make test
```