# **Principles of Customized VLSI Design**

# Spring 1998 CS 45111 / 55111

### Instructor

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# **Teaching Assistant**

none

# **Course Prerequisites**

The 1997-1998 Graduate Schools Catalog lists the prerequisites for this course as CS 4/5101 Computer Organization and Architecture; equivalent courses taken elsewhere are also acceptable. It would be helpful if you have at least a slight background in logic design, although that background is not strictly necessary.

### **Course Overview**

The goal of this course is to provide a "computer science"-oriented introduction to VLSI design.

In a computer engineering program, students might take a semester or two of logic design at the sophomore level, followed by several senior- or graduate-level courses on the internals of a VLSI chip, the use of Computer-Aided Design (CAD) tools, and the algorithms employed by those tools. Furthermore, those courses would be supplemented by additional courses in circuit design, electronics, quantum physics, and computer architecture.

Since we do not have 5-10 semesters of work time available to us in this course, or the benefit of a computer engineering background, this course will concentrate on providing an overview of the VLSI design process, practical training using CAD tools for the design of digital circuits using Field-Programmable Logic Devices (FPLDs), and some understanding of the major CAD algorithms.

### **Textbook**

Several textbooks will be used in this course.

The first textbook is optional, primarily due to the fact that it will only be used in a couple of lectures:

• Workview Office Student Edition, Duckworth, Prentice Hall, 1997.

This textbook is primarily a lab manual — it shows you how to use CAD tools for schematic capture and simulation. Although you will need to read this textbook to prepare for your first project, you may want to share a copy with other students, or simply to read the copy that is available in the "Distributed Operating Systems and VLSI Design Laboratory" (MSB 353) (for use <code>only</code> in that lab). A copy of the Viewlogic Workview Office software will be installed on one or more PCs in the VLSI Design Laboratory; students wanting their own copy of the software (included on a CDROM at the end of the book) should purchase the text.

The second textbook is required, and will be used for over half of the course:

 Digital Systems Design and Prototyping Using Field Programmable Logic, Salcic and Smailagic, Kluwer Academic Publishers, 1997.

You will also need to read this textbook to prepare for your final project. A copy of the Altera Max+PLUS II software will be installed on the HP workstation "vlsi.mcs.kent.edu" and on one or more

PCs in the VLSI Design Laboratory; students wanting their own copy of the software (included on a CDROM at the end of the book) should purchase the text.

The third and final textbook is not required, but I will use it for several lectures at the beginning and end of the course:

• Application-Specific Integrated Circuits, Smith, Addison-Wesley, 1997.

Normally, I would not point out that this book exists, as I often use a variety of additional textbooks in preparing my lectures, and I would be afraid that, by listing those additional books on my syllabus, some students might think that I was somehow suggesting that they should buy those books as well.

In this case, however, I will make an exception because Prof. Smith has very generously put <u>the entire</u> <u>contents</u> of this textbook online in html format. According, when I cover material from this book, you might want to read the online version of that material as well:

http://spectra.eng.hawaii.edu/~msmith/ASICs/HTML/ASICs.htm

# **Class Web Page**

The web page for this class is http://www.mcs.kent.edu/~walker/vlsi.s98 (links to this page, and to my other classes, are all available on my home page). The web page will contain links to the following course materials:

- · Current class syllabus and schedule
- Lecture notes (in PostScript, printed 4-up)
- VLSI design project assignments

Other information may be included as well. You might want to check the web page on a regular basis, in particular when a project is outstanding.

#### Lectures

Students are expected to attend each lecture. I will not take roll, and I understand that it may occasionally be necessary to miss a class, but in general I expect you to attend each lecture

At each class, I will hand out one sheet of paper containing reduced copies of *at most eight* of my slides for that lecture. If you would like to have reduced copies of *all* of my slides for that lecture, the full version of the lecture notes will be on the class web page before the lecture, and you can print them out. Note that you are not required to either look at or print out these notes; they are provided solely for your convenience should you want them. However, you should <u>not</u> consider skimming these notes to be an adequate substitute for attending the lecture, as they will contain only the text of my slides, not the comments that I will make in class.

My lecture notes will be drawn from a variety of sources. The textbooks listed above will serve as a primary reference, although some material will be drawn from other books on logic design, CAD, VLSI design, etc. I may also use lecture notes from other professors as a reference.

# **VLSI Design Projects**

There will be 2 VLSI design projects during the semester. The first will be a paper design using the Viewlogic Workview Office tools, and the second will be a FPGA-based design using the Altera Max+Plus II tools. Tentative due dates are shown on the Class Schedule, attached at the end of this syllabus.

### Late Policies

In general, you will have adequate time to complete each assignment. However, you should begin work on each assignment early so that you will have plenty of time to become familiar with it and with the CAD tools that you will be using, and so that you will have time to "sleep on" the difficult parts. Waiting until two days before the due date to start the project is a bad idea.

Late projects <u>will</u> be accepted with a 10% penalty for <u>each day or portion thereof</u> that the project is late. Other extensions will not be granted, unless you make *prior* arrangements with me, or have a *documented* illness (in which case I expect you to contact me as soon as possible).

#### **Exams**

There will be one exam (held during class) and a final exam (held during finals week). The tentative dates for the exams are shown on the Class Schedule, attached at the end of this syllabus. All exams are closed book and closed notes, and must be individual work. It is expected that you take each exam at the scheduled time, unless you make *prior* arrangements with me, or have a *documented* illness (in which case I expect you to contact me as soon as possible).

# **Academic Integrity**

Student-teacher relationships are built on trust. Students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments which students turn in are their own. Acts which violate this trust undermine the educational process. In this course, the penalty for <u>any</u> act of academic dishonesty is a final course grade of F.

#### Cooperation on VLSI Design Projects

For both homework assignments and programming projects, I strongly believe that discussion with your peers is an excellent way to learn. If you don't understand something, discussing it with someone who does can be far more productive than beating your head against the wall.

Having advocated discussion, then, I must be about clear what is allowed, and what is not. In general, students are allowed to cooperate as follows: you are allowed to discuss with other students the assignment, and general methods for solving the assignment. However, you are not allowed to work with someone else to actually solve the assignment, and you are certainly not allowed to copy anyone else's solution; doing any of these things will be considered cheating, and will be grounds for failing the course.

Note that there is a fine line between discussion and cheating. If you are unsure what is allowed and what isn't, feel free to discuss the distinction with me, but if something feels uncomfortable, it's probably not allowed.

Finally, you should be careful not to give others access to your project. This means that you shouldn't keep your program in a publicly-accessible directory, you shouldn't leave your terminal unattended, and you shouldn't forget to pick up your printouts.

### **Grades**

Your final course grade will be broken down as follows:

•	Programming projects (2)	50%	(Project $1 = 20\%$ , Project $2 = 30\%$ )
•	Exams (2)	40%	
•	Class participation	10%	

The final course grade will be determined with A = 90-100, B = 80-99.99, etc. There will be no curve at the end of the course, so you should always be able to determine your course grade.

### **Students With Disabilities**

In accordance with University policy, if you have a documented disability and require accommodations to obtain equal access in this course, please contact the instructor at the beginning of the semester or when given an assignment for which an accommodation is required. Students with disabilities must verify their eligibility through the Office of Student Disability Services (SDS) in the Michael Schwartz Student Services Center (672-3391).