CSCE 434/834: VLSI Design
Fall 2010 Syllabus

Catalog Description: CSCE434, CSCE834 VLSI Design (3 cr) Lec 3, Prereq: CSCE335 or permission*
Introduction to VLSI design using metal-oxide semiconductor (MOS) devices primarily aimed at computer science majors with little or no background in the physics or circuitry of such devices. Includes design of nMOS and CMOS logic, data-path, control unit, and highly concurrent systems as well as topics in design automation.

* Note that CSCE 335 has not been taught for many years and what I will assume as prerequisites for the course is sufficiently covered in CSCE 230.

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Textbook:
CMOS VLSI Design: A Circuits and Systems Perspective, 4/E, Neil Weste and David Harris, Addison-Wesley: 2011 Format: Cloth; 864 pp. Note that the new edition thoroughly updates all the material in 3/E which was published in 2004. Here are links to the Textbook author David Harris' home page and to his course web page.

Course Focus
This course is intended to make the process of VLSI design accessible to students with only a minimal knowledge of device physics and electrical circuits. Mead and Conway showed that this was possible with the publication of their classic textbook on VLSI design thirty years ago. CSCE 230 (Computer Organization) and a genuine interest in learning the "art" of VLSI design should be sufficient for successfully completing this course

With the rapid evolution of the semiconductor technology, the practice of VLSI design has changed dramatically. In the early days of VLSI design, constraints on silicon real estate were the dominant concern of the designers. Now, using much finer geometries, designers can integrate orders of magnitude more transistors on a chip but face stringent constraints on power, manufacturability, and time-to-market. These changes in the design environment are reflected in this course.

The emphasis in this course is on hands-on design experience. You will be asked to do a set of laboratory exercise, ranging in complexity from a simple gate to a complete processor. In addition, you will also carry out a substantial design project in groups of two and report on it by the end of the semester. You and your partner will need to come up with project specifications by the middle of the semester. I can help you with ideas, if needed. Keep in mind two general constraints as you think about project ideas: the project should represent a *complete system* (e.g., a computer system with processor, memory and basic I/O; a memory system such as cache + SRAM/DRAM; or a networking system involving communication between two subsystems) and it should be *power-aware,* i.e. integrate aspects of low-power design.

In the lectures, I will provide an overview of the VLSI design process, introduce salient measures of performance, and discuss methods for designing circuits at various levels of abstraction and complexity. By doing homework problems on these topics you will be able to demonstrate your understanding of the material covered in the class.

I will start with the introductory material in Chapter 1 of the textbook, continue with techniques for analyzing delay and power consumption of logic gates and wires covered in Chapters 4–6, and finally cover the general principles of designing combinational and sequential circuits (Chapter 9 and 10), datapaths (Ch. 11), and memories of various kind (Ch. 12). In the time remaining, if any, we may cover additional topics from the textbook or elsewhere. Chapter 2 will not be covered in depth as it requires background in semiconductor physics and for Chapter 3, which covers the CMOS processing technology, I will provide you with a video and online sources to learn from.

During the first three weeks of the semester, you will be engaged in learning a CAD tool for custom layout of complementary metal-oxide semiconductor (CMOS) circuits and follow up by completing a set of laboratory exercises *individually*, by the middle of the semester. By this time you should also have your group project specified and you will spend the rest of the semester bringing it to a successful implementation.

Grading

The weights for the three components are shown below:

Homework (about six)	(20%)
Laboratory Exercises (four)	(40%)
Project	(40%)

For conversion of points to a letter grade, I will use the following mapping:

A+	A	A-	B+	B	B-	C+	C	C-	D	F
97-100	93-96	90-92	87-89	83-86	80-82	77-79	73-76	67-72	60-66	<60

Policies

Late Work: All work must be completed when due. As a rule, I will not accept any late work
Attendance: You are expected to attend all the classes and must provide a reason for missing a class before the class. *As a courtesy to other students, be sure to arrive in time for each class.*
Academic Integrity: Cheating or plagiarism is a very serious offense and the CSE Department has laid down strict guidelines for dealing with this problem. The penalty for cheating may include an automatic F grade for the course and expulsion from the program. The Department requires me to report every offense to the Chair for further consideration.
Students with Disabilities: Let me know if you have any learning disability and I will try my best to accommodate you.
Cell Phones, Laptops, iPod: Turn off or silence your cell phone at the beginning of the class. Do not use laptops or iPods during the class unless I explicitly allow you to do so.