ECE 658 VLSI Design Principles
Spring 2017

Syllabus

Course Meetings: Wednesday and Friday 2:30 - 3:45 pm, Marston 220

Instructor: Maciej Ciesielski,   Electrical and Computer Engineering
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Office Hours: TBD.

TA: Atif Yasin, KEB 314, office hours TBD

Course Description:
This is a graduate level course in VLSI design intended for students with sufficient background in basic VLSI Design. The course will cover advanced aspects of modern circuit design, including: ASIC and FPGA design flow; analysis and design of CMOS circuits; advanced logic synthesis; datapath and arithmetic circuits; memory design; CAD tools, simulation, verification, and testing. Lectures will cover theoretical analysis techniques as well as standard design practices of industry. The assigned labs/projects will help students gain experience with commercial CAD tools. Finally, students will be assigned research papers on selected advanced VLSI topics to present in class for credit.

Course Goals:
At the end of this course, you will be able to: Design combinational and sequential circuits all the way from high-level description to layout. You will be able to analyze performance, power and robustness of the circuit; will learn to design arithmetic circuits, to apply the principles of Boolean algebra for logic restructuring to improve power and performance. You will learn principles of design verification and use CAD tools to verify, simulate and debug design for functional correctness and timing closure.

Course Outline:
1. Introduction, course organization
2. Design flow, from behavioral to circuit level
3. CMOS technology overview; ASIC and FPGA solutions
4. Advanced logic design and synthesis techniques
5. Static and dynamic CMOS circuits
6. Computer arithmetic, data path designs
7. Simulation and formal verification; testing
8. Timing analysis; wiring, layout issues
9. Memory design; SRAM, content addressable memory
10. Clocking and advanced latch/flipflop design
11. Transistor level issues: subtreshold operation; gate sizing, stacking
12. Low power design
13. Pipelined designs, parallelism
14. Specialized circuits, I/O circuitry
15. Special topics: MemRistor, Optical proximity correction (OPC)
16. Emerging technologies: FINFET, NanoWires,VISFET, etc.)

Text: *CMOS VLSI Design: A Circuits and Systems Perspective*, Weste and Harris,
4th edition, 2011, the same text as used in ECE 558.
Available new, used or for rent various places, including Amazon at:
http://www.amazon.com/CMOS-VLSI-Design-Circuits-Perspective/dp/0321547748
The text will be supplemented with selected papers on advanced topics. Some of the
research papers will be assigned to students to be presented in class for credit.

Pre-requisites:
Intended for graduate students in Electrical and Computer Engineering or Computer
Science who took Introduction to VLSI (ECE 558) or equivalent. This is a core
graduate course for the PhD program in the ECE Department.

Computer Requirements:
Web access and familiarity with Windows and Linux OS. Students will be provided
with access to CAD tools running on UMass servers.

Grading:
- Mid-term 30%
- Final Exam 30%
- Homework assignments/labs 30%
- Research paper presentation 10%