Course Syllabus

ECE 152A  Digital Design Principles  5 units
(Required)

Catalog Description:
Design of synchronous digital systems: timing diagrams, propagation delay, latches and flip-flops, shift registers and counters, Mealy/Moore finite state machines, Verilog, 2-phase clocking, timing analysis, CMOS implementation, S-RAM, RAM-based designs, ASM charts, state minimization.

Prerequisites:
ECE 15 or 15A or Computer Science 30 with a minimum grade of C- in each course; open to electrical engineering, computer engineering, and computer science majors only.

Text, References, and Software:
Software: Xilinx synthesis software

Topics Covered and Course Goals:
1. Review of Karnaugh maps; combinational logic design problems.
2. Sequential design building blocks: latches, flip-flops; timing diagrams.
3. Sequential machine design: Moore and Mealy machines; word problems; finite state machine design problems; Verilog language.
4. Timing of sequential machines: set-up and hold times, propagation delay
6. Design with random access memories; CMOS implementation.

Verilog language is taught in the lectures in the course, and is then reinforced through Verilog programming in the laboratories.

The course goals are:
1. To raise computer engineers who are fluent in basics of Verilog language, which is the industry standard in digital design,
2. To cultivate the modern digital design principles and practices via hands-on laboratories.
3. To raise students who are able to both understand digital design deeply, and be able to carry out complex designs top-down, beginning with fuzzy word problem descriptions to actual designs using an FPGA board.
4. To teach the principles of the basics of digital design, to prepare for more advanced course work in computer architecture, hardware/software interface, and in preparation for the capstone project in the senior year.
5. To make the course accessible to both computer science and electrical engineering students who take this as a required course, and raise the level of understanding of these students from both backgrounds to a common level in order to allow them to transfer into digital design careers in the future.
6. To reinforce rigorous thinking in a design-oriented framework, to cultivate the students’ reasoning and engineering skills, to prepare a foundation for them in careers even beyond engineering, that require rigorous thinking skills and a methodological approach.
7. To cultivate the principles and practices of team work in an active environment of collaboration on laboratory projects.
Class/Laboratory Hours:
Lecture, 3 hours; laboratory, 6 hours.

Contribution to Criterion 5
“5. Learned to function well in teams. Also, students must develop communication skills, written and oral, both through team and classroom experiences. Skills including written reports, web page preparation, and public presentations are required.”

This course emphasizes very heavy team work. Each of the 5 laboratories are difficult design labs where a substantial amount of design thinking is asked of teams of students. There are 2 students in each team. During this course, the students learn how to understand and then partition the work, how to interface with others on their own team, and how to share responsibility and be accountable together at the end of each lab. The communication skills are crucially used within each laboratory: A pre-lab report is handed in by each team, as well as a final demo of the project, for each of the 5 projects in the course. The written communication skills are emphasized via laboratory reports. Each team presents its demo to the TA’s, at the end of each laboratory. In the classroom, the environment is highly interactive, and questions are encouraged; hence, communication is also emphasize in the classroom setting.

Contribution to Program Outcomes:

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Prepared by: Volkan Rodoplu            Date: 10/05/07