ECE 451: Digital System Design

Class: Scott 229
Lectures: Tu/Th 2:00-3:15 pm
Office Hours: Tu/Th 3:30-5:00pm
Course Credit: 3

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1. **Course Description & Objectives**
   ECE451 is a senior level course on digital design techniques. The purpose of this course is to provide students with opportunities to learn different digital systems and their practical applications, and various design techniques for different types of digital systems. Because this is a course related to designing hardware, a great deal of emphasis will be paid to practical issues in designing digital systems which combine both the software and hardware skills in a top-down design flow. Practical design issues can be understood only by going through a set of extensive design experiments in ECE450 both in the form of software programming at a higher level of design hierarchy and in the form of hardware building and debugging at a lower level of design hierarchy. The behavioral level design of a digital system is often performed using hardware description languages (HDLs) such as Verilog. Students taking this course will learn how to use Verilog to describe behavior and functionalities of any complex digital systems. The gate level implementation of a digital system are mapped to an field programmable gate array device for verification. Therefore, students will go through the entire design process of describing hardware using software languages, mapping it into gates and simulating the gate level design, and finally load the schematic design on to a silicon chip to verify the functionality of the system in hardware.

2. **Prerequisites**
   Students are required to have taken ECE102 and have sufficient knowledge about high-level language programming in C, Java, or C++. Students MUST register ECE450 together with ECE451. ECE450 is the lab component of the ECE451.

3. **Textbook**
   The textbook for ECE451 is "Contemporary Logic Design" by Randy H. Katz.

   The reference books for additional reading are:
   “Digital Design, Principles and Practices" by John Wakerly.
   “Digital Design Fundamentals" by Kenneth J. Breeding, Prentice-Hall, 1992.
   “Computation Structures" by S.A. Ward and R.H. Halstead Jr., McGraw-Hill, 1990.
   “Logic Synthesis" by Srinivas Devadas et. al., McGraw-Hill, 1994.

4. **Webpage**
   This course will use CSU’s Canvas, and the ECE 451 course webpage in Canvas is only accessible to registered students. Lecture notes, assignments, solutions, grades, and general announcements will be posted or linked on the Canvas webpage.

5. **Course Topics**
    - Review of basic logic design, number systems, and basic logic families (Chaps. 1, 2, and 3)
    - Introduction to Verilog/VHDL and design tools
    - Design of combinational logic (Chap4 and 5)
    - Design and optimization of sequential logic state machines (Chap7 and 8)
    - Examples of some sequential logic and memory circuits and their implementation (Chap9, 10, and 11)
    - Introduction to programmable logic devices
    - Implementing combination logic with PLDs (Chap6)
    - Arithmetic logic
    - Design of data path logic
    - Design of control logic

6. **Grading:** Percentage for different assignments are given in the table below. The grade is determined according to the table at right below.

Assignments	Weights	Grading Scheme	
Homework	10%	90-100%	A
Midterm-1	25%	80-89.9%	B
Midterm-2	25%	70-79.9%	C
Final Exam	40%	60-69.9%	D
Total	100%	< 60%	F

Homework: Homework assignments are posted online, and they are due at the beginning of the class on the day one week after the date of posting. All homework assignments should be submitted before the deadline via Canvas, and **late submissions will not be graded**!

7. **CSU Principles of Community**
    - Inclusion: We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions.
    - Integrity: We are accountable for our actions and will act ethically and honestly in all our interactions.
    - Respect: We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.
    - Service: We are responsible, individually, and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.
    - Social Justice: We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.