ECE 450/451: Digital System Design/Lab

IN

Number Systems and Boolean Algebra

- Understand fundamentals of number systems and Boolean algebra

Logic

- Know truth tables and canonical expansions
- Has introduction to K-maps

Gates and Logic

- Understands representation of logic as gate-level schematics

Energy and Radiation

- Has knowledge of sequential building blocks
- Has exposure to FSMs

Pre-requisites

- ECE102 with a C or higher; ECE202 with a C or higher

Concepts:

- Basic implementation of logic gates
- Design representation (gate schematics, HDL)
- Logic families and digital circuit behavior
- Boolean algebra, switching theory, logic minimization (algebra, cubes, Quine-McCluskey, CAD tools)
- Logic synthesis (multi-level gates, function blocks, programmable logic)
- Advanced finite state machine synthesis (state enumeration, minimization, encoding, partitioning)
- Synchronous design (clocking methods, timing parameters, metastability)
- Computer system design fundamentals (ALU, data path, control)
- Design trade-offs (area, speed, power)
- Design methodology and design flow for complex logic circuit

Applications:

- Complex combinational circuits
- Complex sequential circuits: counters, FIFOs, sequence generators
- Systems and subsystems: CPU, I/O controller, memory management

Tools:

- Design tools: schematic capture, digital simulation, HDL compilation and synthesis, debugging and validation of hardware

OUT

CMOS Logic

- Understand how CMOS logic circuits are composed to perform arbitrary logic functions

Hardware Description Language

- Use schematic and HDL representation of combinational and sequential logic

Logic Minimization

- Understand complex logic minimization through Quine-McCluskey and CAD methods

Arithmetic Logic Design

- Understand the techniques for common arithmetic logic design

Finite State Machine Design

- Design and optimize a complex finite state machine from design specifications

Programmed Logic

- Understand complex logic implementation in programmable devices: PLA/PLD, FPGA

Micro-Architecture

- Has knowledge of aspects of computer system micro-architecture and design

Knowledge of Design Methodology and Design Flow

- Use a variety of design and simulation tools to design and validate complex logic circuits