

Electrical Engineering 457: Digital Logic Lab

Course Description: Digital Logic Lab. 3 Cr. U. Combinatorial and sequential logic design using logic gates and Programmable Logic Devices. Emphasis on design implementation using VHDL. Prereq: ElecEng 354; ElecEng 301 (C).

Textbook: Recommended : Digital Design, Wakerly, Prentice Hall

Prerequisites by Topics:

- Boolean Logic.
- Knowledge of basic logic design using truth tables, K-maps, and state tables.
- Basic theory of electrical circuits and devices.

Course Learning Outcomes:

- Students will be able to design combinatorial logic designs using 74xx series gates and MSI chips.
- Students will understand the internal structure of CPLD's and FPGA's and how these devices implement logic functions.
- Students will be able to implement combinatorial logic functions using VHDL RTL descriptions.
- Students will be able to design sequential logic circuits using state tables, state diagrams, and VHDL behavioral descriptions.
- Students will be familiar with the engineering process steps of requirements analysis, design, verification, and validation.
- Students will be able to analyze circuits using computer-aided design and analysis tools (Pspice, VHDL logic compiler).
- Students will understand common digital logic design concepts such as parallel and serial data busses, memory devices, and input-output interfacing.
- Students will be able to perform timing and loading analysis of digital circuits.

Topics Covered:

- Combinatorial logic design using truth tables and K-maps.
- PLD, CPLD, and FPGA programmable devices.
- VHDL hardware description language
- Basic logic building blocks, muxes, encoders, decoders, registers, counters, latches.
- Synchronous finite state machine design.
- Memory devices and microprocessor busses
- Mixed signal design, analog to digital converters.

Class/Laboratory Schedule: 15 combined lecture-laboratory sessions

Contribution of Course to Meeting the Professional Component:

This course contributes to the engineering topics component of the curriculum, primarily in engineering design. Students learn fundamental electrical engineering design concepts related to the design of digital logic circuits.

Relationship to Program Objectives:

Program Outcome	Explanation
iii.	Students use current practice digital design techniques and devices, VHDL and CPLD's.
iv, v, vii, x.	Students produce designs from written requirements, build their designs, and produce reports on their design process.
iv,xi, xiii.	Students will work in teams on lab design problems.

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Methods of Assessment:

- Graded lab reports
- Graded examinations
- Course evaluation by students
- Instructor judgment

Resources Commonly Available:

- Instructor
- Course web site
- PSpice software, Lattice VHDL design software

Desirable Student Competencies:

- Basic electrical theory, Boolean algebra, digital logic fundamentals