Catalog description

Advanced techniques in the design of digital systems. Hardware description languages, combinational and sequential logic synthesis and optimization methods, partitioning, mapping to regular structures. Emphasis on reconfigurable logic as an implementation medium. Memory system design. Digital communication including serial/parallel and synchronous/asynchronous methods.

Prerequisites

CSE 326; CSE 370.

Course objectives

[P] 1.To learn how to design digital systems, from specification and simulation to construction and
debugging.
[P] 2.To learn techniques and tools for programmable logic design
[P] 3.To learn how to use modern laboratory test equipment, including logic analyzers and oscilloscopes.
[P/C] 4.To understand the limitations and difficulties in modern digital design, including wiring constraints, high-speed, etc.
[P] 5.To design, construct, test, and debug a moderate-scale digital circuit.

Topics covered

Overview of digital technology
[C] Logic families
[C] TTL/CMOS
[P] Reading and understanding data books
[P] Interfaces
[C] Standard components
[P] Programmable devices
[C] PROMs
[C] PALs and PLDs
[P] FPGAs
Electrical realities
[P/C] Resistance, capacitance and inductance
[P] Wire delays and time constants
[C] Fanout and loading
[P] Decoupling and signal integrity
[P] Power dissipation and drops
[P] Ringing, reflections, and terminations
[P/C] Clock distribution
Computer-aided design
[P] Hardware description languages (HDLs, esp. Verilog)
[P] Logic compilation
[P/C] Two-level and multi-level logic synthesis
[C] Technology-independent optimization

[P] Technology mapping
[P] Sequential-logic synthesis
[P] Tools for mapping to PLDs and FPGAs
Laboratory
[P] Logic analyzer and oscilloscope basics
[P] Timing, state, capture, bandwidth
[P] Glitches and transient events
[P] Debugging techniques
System-level components
[P] Static, dynamic, and nonvolatile memories
[P] RAM, ROM, PROM, EPROM, EEPROM
[P] Memory controllers and timing
[P] Digital communication
[P] Serial and parallel protocols
[P] Synchronous vs. asynchronous data communication
[P] Busses
[P] Arbitration

ABET Outcomes Assessed

[P] (a) an ability to apply knowledge of mathematics, science, and engineering
[P/C] (c) an ability to design a computing system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
[P](k) an ability to use the techniques, skills, and modern computer engineering tools necessary for engineering practice

Additional ABET Outcomes Covered

[P] (b) an ability to design and conduct experiments, as well as to analyze and interpret data
[P] (e) an ability to identify, formulate, and solve computer engineering problems