

Course Description

Design and synthesis of digital circuits with main emphasis on sequential logic taught through project-based learning approach. Laboratory assignments make extensive use of VHDL and FPGAs and prepare students for an open-ended project undertaken in the remaining part of the course. *Prerequisite(s)*: ELEC1100 Introduction to Electro-Robot Design

List of Topics

Lecture Topics

- 1.Number Systems, Digital Codes, and Parity Error Detection
- 2.Signed and Unsigned Binary Numbers and Operations
3. Boolean Algebra, Logic Gates, and Combination Logic Blocks
4. Combinational Logic Design
5. Sequential Logic Design
6. Sequential Logic Analysis
7. Finite State Machines (Mealy and Moore)
8. Counters and Registers
9. VHDL and FPGA (Labs and Tutorials)

Laboratory Topics

1. Introduction to Vivado & FPGA Basys3 Board
2. Three-input NAND Gate & Three-input NOR Gate
3. XOR Gate & Full Adder
4. Four-bit Adder
5. Four-bit Adder-Subtractor
6. Four-bit Binary Up Counter
7. Four-bit Adder-Subtractor with Seven-segment LED Displays
8. Miniproject

Statement of Objectives/Outcomes:

On successful completion of this course, students will be able to:

- CO1 – Describe and analyze sequential logic circuits
- CO2 – Design, model, and simulate sequential logic circuits using register-transfer level (RTL) design abstractions and hardware description languages (HDL)
- CO3 – Design, implement, and test sequential circuits and systems using field-programmable gate arrays (FPGAs)
- CO4 – Develop a model engineering system following a hierarchical design principle

Textbook(s):

Digital Fundamentals by Thomas L Floyd, Global Edition, 11th Edition,
Print Book ISBN: 9781292075983.

Reference book(s):

Digital Design by M. Morris Mano & Michael D. Ciletti, Global Edition, 6th Ed
ISBN: 9781292231167

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework ¹	0%
Class participation ²	10%
Project ³	15%
Lab	25%
Midterm Examination	25%
Final Examination	25%

¹Homework assignments will be graded and taken into consideration when further reference is needed about the student performance.

²Classes will be delivered in-person on campus until a further notice. Class participation in the case of real-time online mode or mixed-mode delivery involves items like (but not limited to) responding to online polls, and ad/hoc calls either through audio or chat, keeping video on during online lectures

³Students must complete ALL labs and the project in order to pass the course. All labs count.