[ELEC3310] [Digital Fundamentals and System Design] [Fall 2023/24] [Credits: 4]

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.

List of Topics

Lecture Outline

1a	ELEC3310 OBE
1b	Lecture notes 00 - Course introduction Lecture notes 01 - Introductory concepts Lecture notes 02 - Combinational logic
2	Lecture notes 03 - Combinational logic
3	Lecture notes 04 - Combinational logic
4	Lecture notes 05 - Sequential Logic
5	
6	Lecture notes 06 - FSM and counters Midterm exam on Oct 12 (Thu) during lecture time. Exercises - Combinational Circuit
7	Lecture 07 - FSM Design and Implementation
8	Lecture 08 - FSM Analysis
9	
10	Lecture 09 - FSM Registers Lecture 09 register animation
11	Lecture10 - FSM Counters

12	Lecture11 - FSM Latches, Flip-flops and FPGA.pdf
13	Lecture11 - FSM Latches, Flip-flops and FPGA.pdf

Laboratory Outline

Week 3	Lab 1: Introduction to Vivado & FPGA Basys 3 board
Week 4&5	Lab 2: XOR Gate Array and Full Adder
Week 6	Lab 3: 4-bit Adder
Week 7	Lab 4: 4-bit Adder/Subtractor
Week 8	No Lab
Week 9	Lab 5: 4-bit binary up counter
Week 10&11	Lab 6: 4-bit Adder/Subtractor with 7-segment displays
Week 12	Project: 4-bit Overlapping Sequence detector
Week 13	Project demo [NOV 27 (LA2) & NOV 29 (LA1)]

Intended Learning Outcomes:

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

LO1 – Describe and analyze sequential logic circuits (see PO1, PO2, and PO3)

LO2 – Design, model, and simulate sequential logic circuits using register-transfer level (RTL) design abstractions and hardware description languages (HDL) (see PO3)

LO3 – Design, implement, and test sequential circuits and systems using field-programmable gate arrays (FPGAs) (see PO3, PO10, and PO11)

LO4 – Develop a model engineering system following a hierarchical design principle (see PO3, PO4, PO6, PO7, PO10, and PO11)

Students will get the opportunity to work in a team environment as well as learn and practice effective project and time management skills.

Textbook(s):

Title: Digital Fundamentals, Global Edition, 11th Edition
Author: Thomas L Floyd
Print Book ISBN: 9781292075983

Reference Books/Materials:

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

Relationship of Course to Program Outcomes:

- *Problem sets* / *written exam questions* for students to *apply* their understanding of the basic concepts in digital circuits and systems to *work out* problems, *design* or *analyze* simple digital circuits and systems (LO1 and LO2)

- *Laboratory experiments & Project (with written report submission)* for students to *apply* their knowledge of digital circuits and systems by conducting formulated experiments and an open-ended project to *illustrate* and *document* their findings (LO1, LO2, LO3, and LO4)

Grading Scheme:

Homework	0% (*Homework assignments will be graded and taken into consideration when further reference is needed about the student performance)*
Laboratory	30%
Project	20%
Mid-Term Examination	25%
Final Examination	25%