The University of Texas at Tyler
Department of Electrical Engineering

Course: EENG 4332/5335 – FPGA Design

Syllabus

Catalog Description:

Digital Systems design with Field Programmable Gate Arrays (FPGAs); Design and synthesis of reconfigurable logic with High-level Hardware Description Language; Logic Design using FPGAs; Architectural and System Design issues; Reconfigurable computing with FPGAs. Three hours of lecture each week.

Prerequisites: EENG 3307 Microprocessors and EENG 4309 Electronic Circuits II or Consent of Instructor

Credits: (**3** hours lecture, **0** hours laboratory per week)

Text(s): Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design. 3rd Edition. Mc Graw Hill, 2014. ISBN 9780073380544

Additional Material(s): Peter J. Ashenden, The Student's Guide to VHDL. 2nd edition. Morgan Kaufmann, 2008.

Class Notes; Journal Articles

Course Coordinator: Kazi Rashed, Electrical Engineering

Topics Covered:
(Paragraph of topics separated by semicolons)

VLSI CAD Tools; Fabrication of Integrated Circuits; Modeling Submicron Transistors; Static and Dynamic Logic Gate Design; Datapath design; Subsystem design; Delay, Power Characterization; Clock Distribution; Physical Design; Interconnect Modelling; Testing and Verification Issues.

Evaluation Methods (Only items in dark print apply):

1. Examinations/ Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Objectives[1]: By the end of this course students will be able to:

1. Explain how FPGAs are used in digital system design. [1,2]
2. Design digital logic circuits using VHDL. [1,2]
3. Use CAD tools in the design, simulation, and implementation of FPGA designs. [4,5]

4. Analyze the implementation of reconfigurable logics in a VLSI process [1]
5. Design and implement Combinational and sequential logic circuits with FPGAs. [1,2,7]
6. Optimize the device sizing for a complex logic circuit using the concept of logical effort. [1,2]
7. Determine the delay in CMOS circuits. [1]
8. Characterize a CMOS logic gate utilizing SPICE simulation data. [4,5]
9. Implement transistor-level schematic of compound CMOS logic gates. [2]
10. Assess the design challenges of implementing dynamic logic circuits in submicron technologies. [1]
11. Analyze different memory architectures in the transistor-level. [1,2]
12. Identify the issues with testing complex logic circuits. [1,2]
13. Understand the issues with designing devices and circuits using nanotechnology. [1]
14. Explore the real-time advance applications of FPGA boards. [3,6]
15. Explore the current research trend in VLSI Design. [6]

[1] Numbers in brackets refer to method(s) to evaluate the course objective

Relationship to Program Outcomes (only items in dark print apply)[2]. This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. Have the ability to apply knowledge of the fundamentals of mathematics, science, and engineering; [1,2]
2. Have the ability to use modern engineering tools and techniques in the practice of electrical engineering; [3,8]
3. Have the ability to analyze electrical circuits, devices, and systems; [9,10]
4. Have the ability to design electrical circuits, devices, and systems to meet application requirements; [4,11]
5. Have the ability to design and conduct experiments, and analyze and interpret experimental results;
6. Have the ability to identify, formulate, and solve problems in the practice of electrical engineering using appropriate theoretical and experimental methods; [6,12,]
7. Have effective written, visual, and oral communication skills; [15]
8. Possess an educational background to understand the global context in which engineering is practiced, including:
    a. Knowledge of contemporary issues related to science and engineering; [14]
    b. The impact of engineering on society;
    c. The role of ethics in the practice of engineering;
9. Have the ability to contribute effectively as members of multi-disciplinary engineering teams;
10. Have a recognition of the need for and ability to pursue continued learning throughout their professional careers; [13]

[2] Numbers in brackets refer to course objective(s) that address the Program Outcome.

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:	0	hours
Engineering Sciences and Design:	3	hours
General Education Component:	0	hours

Prepared By:		
	Prabha Sundaravadivel Revised by Kazi Rashed	22-Aug-2018 08-Jan-2020

COURSE OUTLINE

Course Coordinator:

Dr. Kazi Rashed

Senior Lecturer, Department of Electrical Engineering
Office: A212

Email: krashed@uttyler.edu

Office Hours: Tue 1:00 PM – 3:00 PM, Thu 1:00 PM – 3:00 PM

Class Location/Time:

EENG 4332.031 – Houston Engineering Center 0A216

Grading Policy:

Participation	15%	Attendance (5%), occasional short assignments (FSM) or quiz, and engagement through discussions.
Project	35%	
Exams	50%	2 Exams
Total	**100%**	

Semester Schedule (tentative):

Week	Date	Topics
1	13-Jan-2020	Chapter 1 Reading Assignment 1.1-1.6
2	20-Jan-2020	Chapter2: Reading Assignment 2.1- 2.8
3	27-Jan-2020	Chapter 2: Reading Assignment 2.10-2.12
4	3-Feb-2020	Chapter 3: Reading Assignment 3.1,3.2, 3.5,
5	10-Feb-2020	Chapter 4: Reading Assignment 4.1, 4.2, 4.3, 4.5
6	17-Feb-2020	Chapter 4: Reading Assignment 4.6
7	24-Feb-2020	Exam 1
8	2-Mar-2020	Project Progress Presentation
9	9-Mar-2020	Spring Break
10	16-Mar-2020	Chapter 5: Reading Assignment 5.1-5.6
11	23-Mar-2020	Chapter 6: Reading Assignment 6.1 -6.4
12	30-Mar-2020	Chapter 6: Reading Assignment 6.5 -6.7

13	6-Apr-2020	Chapter7: Reading Assignment 7.1-7.8
14	13-Apr-2020	Exam2
15	20-Apr-2020	Project
16	27-Apr-2020	Project Presentation

Short Assignment and Quiz:

There will be about 3-4 short assignments or quiz, after significant topics such as Finite State Machines, is discussed in the class. The purpose of this is to help in assessing the understanding of topics. About a week's time would be given for each assignment submission and quiz preparation. This will account for 10% of grade. No late submissions will be accepted. Assignment problems/ questions may be discussed with other students, but the final submission should be an original and independent solution.

Project:

Project will be based on Basys 3 FPGA boards. Students can either form a group of 2-3 or do the projects individually. Students can choose the topic for the project either from the given topics or choose their own. Project topics will be given by Jan 31, 2019. The tentative schedule for project completion is:

Abstract submission (5%) due – February 05, 2020

Mid Term Progress Report (10%) due – March 02, 2020

Final Report (10%) due – April 20, 2020

Project Presentation (10%) due –April 27, 2020

Research Reading Assignments: (For Graduate Students)

Two research papers will be assigned before the Mid-Term week. Students are expected to read them and make a 10-minute presentation for each paper. This presentation will be reviewed on last 2 weeks of the course. The total of 20-minute presentation will have 10% weightage.

Exams:

This course will have 2 exams with 25% weightage for each. There is no Final Exam for this course.

Academic Integrity:

Students should be aware that absolute academic integrity is expected of every student in all undertakings at the University of Texas at Tyler. A plagiarism check will be done all the reports submitted by students. Copied or unoriginal solutions will result in a "0" in that course component. An evidence of a pattern in academic dishonesty will lead to strong university-imposed penalties.

Attendance:

As an emphasis on consistent participation of students throughout the course, attendance will be taken after each class lecture.

Accommodation:

If you have a disability, including a learning disability, for which you request disability support services/accommodation(s), please contact the Disability Support Services office, so that the appropriate arrangements may be made. In accordance with the Federal Law, a student requesting disability support services/accommodation(s) must provide appropriate documentation of his/her disability to the Disability Support Services Counselor. For more information, call or visit the Student Accessibility and Resources Center located in the University Center, Room 3150. The Telephone number is 903.566.7079. Additional information may also be obtained at the following UT Tyler website: https://www.uttyler.edu/disabilityservices/

Happy Learning!