The University of Texas at Tyler
Department of Electrical Engineering

Course: EENG 4332.001, 4332.040 – 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 Languages; 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: Prabha Sundaravadivel, Assistant Professor, Electrical Engineering

Topics Covered:
(Paragraph of topics separated by semicolons)

Digital system Design with FPGAs; Using CAD tools; Combinational and equential Logic Design using FPGAs; Architectural issues; Fine-grained versus coarse-grained fabrics; Advance applications of FPGAs; System Design 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 Verilog and VHDL. [1,4,5]
3. Use CAD tools in the design, simulation, and implementation of FPGA designs. [3,4,5]
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. Design and implement Finite State Machines using HDL [1,2,4]
7. Identify the issues at the architectural level associated with reconfigurable logic. [1,7]
8. Explore the real-time advance applications of FPGA boards. [3,6]
9. Explore the current research trend in FPGA 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. Have the ability to use modern engineering tools and techniques in the practice of electrical engineering; [3]
3. Have the ability to analyze electrical circuits, devices, and systems; [4,5]
4. Have the ability to design electrical circuits, devices, and systems to meet application requirements; [6]
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; [2]
7. Have effective written, visual, and oral communication skills; [7]
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; [8]
   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; [9]

[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

Date: 15-Jan-2019

The University of Texas at Tyler
Department of Electrical Engineering

Course: EENG 4332.001, 4332.040 – FPGA Design

COURSE OUTLINE

Course Coordinator:

Dr. Prabha Sundaravadivel,
Assistant Professor, Department of Electrical Engineering
Office: RBN 1008
Email: PSundaravadivel@uttyler.edu
Office Hours: Thur 11 AM – 12:30 PM, 2:30 PM – 4:00 PM
Email and Discussion Boards.

Class Location/Time: EENG 4332.001 – RBN 02012,

EENG 4332.040 – Houston Engineering Center 0A216

Grading Policy:

Participation	15%	Attendance (5%), occasional short assignments (FSM) or quiz, and engagement through discussions.
Project	35%	
Reading Assignments	10%	2 Research Papers
Exams	40%	2 Exams
Total	**100%**	

Semester Schedule (tentative):

Week	Date	Topics
1	Jan 17	Course Overview, Introduction to FPGA and system level implementation
2	Jan 24	Introduction to logic circuits and FPGA architecture
3	Jan 31	Introduction to Verilog and VHDL
4	Feb 7	Number Representation and Combinational circuit
5	Feb 14	Combinational Circuit
6	Feb 21	Sequential Circuit
7	Feb 28	Exam 1
8	Mar 7	Sequential Circuit
9	Mar 14	Spring Break
10	Mar 21	Synchronous Sequential Circuits
11	Mar 28	Synchronous Sequential Circuits
12	Apr 4	Synchronous Sequential Circuits
13	Apr 11	Exam 2
14	Apr 18	Research Paper 1,2 Review

15	Apr 25	Research Paper 1,2 Review
16	May 2	Finals week - 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 – Feb 21, 2019

Mid Term Report (10%) due – March 21, 2019

Final Report (10%) due – April 30, 2019

Project Presentation (10%) due – May 2, 2019

Research Reading Assignments:

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.

Exam:

This course will have 2 exams with 20% 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!

UNIVERSITY POLICIES AND ADDITIONAL INFORMATION THAT MUST APPEAR IN EACH COURSE SYLLABUS

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link:

http://www.uttyler.edu/wellness/rightsresponsibilities.php

Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at: http://www.uttyler.edu/about/campus-carry/index.php

UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support.

For more information on cessation programs please visit: www.uttyler.edu/tobacco-free.

Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement

Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university.

For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit: https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an

identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit.

If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:
   - copying from another student's test paper;
   - using, during a test, materials not authorized by the person giving the test;
   - failure to comply with instructions given by the person administering the test;
   - possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
   - using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
   - collaborating with or seeking aid from another student during a test or other assignment without authority;
   - discussing the contents of an examination with another student who will take the examination;
   - divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
   - substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
   - paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
   - falsifying research data, laboratory reports, and/or other academic work offered for credit;
   - taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by plagiarism software.

UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)