EE 2169 – "Lab for EE 2369"
Digital Systems Design I Lab
Non-EE major section

❖ **Lab Description:** Implementation and testing of combinational and sequential digital systems.

Prerequisite: EE 1305 and EE 1105, each with a grade of "C" or better; or CS 1301 and CS 1101, each with a grade of "C" or better; or CS 1401 with a grade of "C" or better.

Co-requisite: EE 2369 (Digital Systems Design I). There are software simulation projects, performed in this lab, that are associated with this class. The student is responsible for completing the labs and submitting reports and evidence of lab completion through the Blackboard system. Students have the option to meet with the Teaching Assistant at the scheduled office hours. Please note that the lab is 1 credit hour, and the grade for that lab is calculated separately from the grade in this class.

Course Outcomes:

At the end of this course students will be able to:

- Utilize the standard design sequence outlined below to create Digital Logic Systems
- Use the Xilinx, Altera or LabView development environments to implement designs
- Implement Digital Logic Systems in various forms
- Design via Verilog (HDL) or schematic capture modules found in the development platform.

❖ **Lab Format:**

- The delivery format of EE2169 lab will be **hybrid** with asynchronous components. Some tasks and extra credit work will require students to visit the on-campus labs at scheduled times.
- **Accessible asynchronous content** – Students will be able to access resources (lab assignments, recorded video lectures, and other provided materials) in their own time and work at their own pace**.** All lab resources will be delivered through the lab Blackboard shell. Please be proactive and complete these academic activities by diligently keeping track of your own progress**.** You will be able to submit lab materials using the upload links located in our lab Blackboard shell.
- **Lab Work –** Every week, students are expected and required to log into Blackboard and Gradescope and complete the instructions of the weekly assignments. Assignments will include online assessment problems, design tasks that need to be completed offline and then uploaded as pdf documents, and demonstration of lab work in the form of short video clips. *Make sure to monitor your own progress, especially as you work on the asynchronous activities and meet the posted deadlines.*
- There is an optional time slot each week for students to access the computer lab at E340 and discuss problems with TAs or demonstrate lab work. Bonus points will be awarded to students who successfully demonstrate lab work in-person during these sessions. A certain number of labs might require students to demonstrate lab work in-person on FPGA hardware. Students are encouraged to bring their own laptops to demonstrate lab work or problems.
- **Office Hours –** There will be optional office hours to meet with the TA through Blackboard or MS Teams. During these live-sessions students will have the opportunity to ask questions (on chat or audio/video).

❖ Technology Requirements:

- **Blackboard (BB) shell and Gradescope access** – Course content is delivered via the Blackboard Learning Management System (LMS), where you will find all our course resources, announcements, virtual offices sessions, a virtual meeting room for student-student collaborations, etc. Assignments will need to be completed and uploaded via Gradescope and Blackboard.
- **Internet connection** – that allows accessing documents, videos, and other resources from the Blackboard shell, completing online assignments, as well as uploading and submitting documents and videos. Although not mandatory, the connection should ideally be stable enough to support one-on-one video conferencing via Blackboard sessions with TAs during Virtual Office hours.
- **@miners e-mail account** – Official class communication should be using this domain.
- Access to a **laptop/desktop computer** – Device should be enabled with webcam, microphone, and ability to install required software. *Most tablets do not fulfill all the requirements*. The device should be capable of running **Xilinx VIVADO 2017_2 (or newer), LabVIEW 2017 (or newer)** and **ALTERA Quartus**. All required software is available on the UTEP E340 & E319 lab computers. Access instructions and timings are available on Blackboard.
- **PDF files** – Ability to create PDF files to upload assignments (by converting directly from Word to PDF, using a scanner or using a scanning app).
- **Video recording capability** – Ability to record short video clips using a smartphone or other recording device to document successful completion of lab work.

❖ Communication and Collaboration:

- **Teaching Assistant** – The teaching assistant is your main point of contact regarding any lab related queries. Contact information and the office hour schedule of your TA can be found on Blackboard. The TA will hold office hours virtually several days a week and will be present in-person during the weekly (optional) lab sessions. You are advised to join the TA office session during office hours if you need any help with lab activities. You are strongly suggested to have access to a microphone when you join the TA office session to ensure quick and smooth communication. At other times, you may contact the TA through Microsoft Teams or via email.
- **Classroom NetEtiquette/ Student Conduct** – Remember that you must be courteous, respectful, and professional in the way you address others; either in writing (email, chat, discussion boards), or during one-on-one sessions at virtual office with instructor and lab TAs. Harassment or inappropriate conduct online or in-person will not be tolerated.
  Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted in these online spaces is intended for classmates and instructor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space. If students wish to do so, they have the ethical obligation to first request the permission of the writer(s).

❖ Outline of Lab Work

Labs with two tasks are to be completed over the course of two weeks.

Lab #	Experiment Name	Summary of Tasks
1	Implementation of Logic Gates	Simulate the operation of basic logic gates (AND, OR, NOT) in LabVIEW using schematic capture.
2	Implementation and Simulation of Logic Expression in Vivado	1) Simulate a combinational logic equation in Vivado using Verilog code. 2) Simulate the same combinational logic equation in LabVIEW using schematic capture. *Extra Credit*: (On campus at E340 lab) Implement the logic equation into the Basys-3 FPGA board.
3	Standard Forms and Logic System Design	1) Simulate a combinational logic system from standard form Boolean equations. 2) Design and Simulate a minimized combinational logic system for a simple alarm system.
4	Decimal Number to Dot System Encoder	Design and Simulate a minimized combinational logic system for a Decimal-to-Dot encoder.
5	Binary 4-bit adder with Register	1) Simulate a modular 4-bit adder. 2) Simulate a system that uses a 4-bit register and to store the output of the modular 4-bit adder.
6	Counters	Design and Simulate a 3-bit counter which loops through a given count sequence.
7	Finite State Machines (FSM)	1) Simulate a provided design to control traffic lights at a 3-way intersection. 2) Use knowledge of FSMs to expand the given design and Design an FSM for a 4-way intersection. Simulate this new design.
8	Algorithmic State Machine (ASM) and Register Transfer Level (RTL) design	Simulate a system to control the lights in a crosswalk from a given ASM chart

❖ Lab Work Guidelines:

Each lab is divided into three important tasks: **Pre-lab, Demonstration,** and **Lab Report**.

Pre-lab:

- A set of **short questions** that need to be completed and submitted in preparation for a particular lab.
- Reading material and/or video explanations required to successfully complete the pre-lab will be provided on the appropriate lab assignment folder in Blackboard.
- The assignment itself will need to be completed on **Gradescope** by the **due date**.

Design and Demonstration:

- A set of **design** and **software simulation** tasks that need to be completed and documented.
- Instructions for the tasks will be provided through a Lab Assignment document for each lab in Blackboard along with necessary reading material and/or video explanations.
- Students are expected to complete the design task using the reference material and ask for guidance from the TA if required.
- Students are then expected to use the appropriate software tool to complete all the simulations tasks. All required software is available on the UTEP E340 & E319 lab computers. Access instructions and timings are available on Blackboard.
- The successful completion of the task(s) needs to be documented through:
  a) A set of **screenshots** of intermediate steps and final results (to be included in report).
  b) A short **video clip** (2 minutes or shorter) demonstrating the final result and/or selected intermediate steps (to be specified in Lab Assignment document). There is a 10% points bonus on this task for demonstrating the lab work to the TA in-person during the optional lab sessions, instead of submitting a video clip. To be eligible, this in-person demo has to be presented in a lab session **before** the demo video deadline.
- The recorded video clip must be uploaded using the appropriate link on **Blackboard** in order to get points for this task.

Lab Report:

- The final assignment for each lab that summarizes the work done and results obtained from the experiment.
- The assignment itself will need to be completed on **Gradescope** by the **due date**. Students will be required to access the relevant Lab Report assignment on Gradescope, fill out all the sections, answer questions and upload documents as needed.

❖ Course Grading:

Scale for Letter Grades:	Lab Grading Rubric:
90% - 100% → A	Pre-Lab Quiz ..... 20 pts
80% - 89% → B	Lab Demonstration Video ..... 40 pts
70% - 79% → C	Lab Report ..... 40 pts
60% - 69% → D	
0% - 59% → F	

❖ General Course Policies:

- Any lab work must be completely and successfully completed in order to be eligible for full credit. Make sure to study all resources provided on Blackboard for a particular experiment before attempting the tasks. If you are struggling with a task, consult your TA during lab sessions, office hours, or over email.
- All lab work should be submitted by the deadline indicated (all times are local El Paso–Mountain Standard Time zone). Late submissions might be accepted with special **written** medical, legal, military, or work justification. Special circumstances will be considered if reported in time. Some additional late submissions will be accepted with a late penalty proportional to the delay.
- **Any document or image submitted for this lab must be in the pdf format**. This includes all (scanned) handwritten work, drawings, screenshots, and computer composed documents. If you need help creating pdf documents, please contact the TA.
- Any handwritten/drawn work that is scanned and uploaded must be neatly organized and clearly legible. All diagrams must be uncluttered and appropriately annotated. Any written work must have proper grammar and spelling.
- While collaboration in solving the tasks and troubleshooting problems is accepted and encouraged, any submitted work (written answers, comments, drawings, video, code, software files, etc.) must be your own.
- Samples of student work will be collected for quality assurance purposes. Please notify the professor, in writing, if there is any confidentiality requirement about any work that is submitted.
- All work must have good presentation for full credit.

❖ **Copyright statement for course materials**: All materials used in this laboratory (such but not limited to recordings, assignments, handouts, quizzes) are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course**. You may not further disseminate (i.e., share, send or post) any class materials/resources outside of this course. Doing so may result in disciplinary action.**

❖ **Academic Dishonesty:** As an entity of The University of Texas at El Paso, the Department of Electrical and Computer Engineering is committed to the development of its students and to the promotion of personal integrity and self-responsibility. The assumption that a student's work is a fair representation of the student's ability to perform forms the basis for departmental and institutional quality. All students within the Department are expected to observe appropriate standards of conduct. Acts of scholastic dishonesty such as cheating, plagiarism, collusion, the

submission for credit of any work or materials that are attributable in the 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 will not be tolerated. Any case involving academic dishonesty will be referred to the Office of Student Conduct and Conflict Resolution (OSCCR). See the OSCCR homepage at http://sa.utep.edu/osccr/ for more information.

- **American Disabilities Act:** If you feel you may have a disability that requires accommodations, contact the Center for Accommodations and Support Services (CASS, http://sa.utep.edu/cass) at 747-5148 located in the Union East, Room 106.

- **COVID-19 Precautions:** If you are experiencing COVID-19 symptoms, wearing a mask during in-person sessions, particularly when in close quarters or crowded settings, is highly encouraged. Details about COVID-19 testing and reporting at UTEP can be found at the following links:
  - https://www.utep.edu/chs/covid-testing/index.html
  - https://www.utep.edu/ehs/covid/