### ECE 2700: Digital Circuits

**Instructor:** Dr. Zhen Zhang, ECE Dept  
**Office Location:** ENLABS 176  
**Email:** zhen.zhang@usu.edu  
**Lectures:** Mon., Wed., & Fri., 9:30AM – 10:20AM  
**Lecture Location:** ENGR 302  
**Credit Hours:** 4  
**Office Hours:** Mon. & Wed., 10:30AM – 12:00PM, or by appointment  
**Course Communication:** Canvas (Send your questions through Canvas email.)

#### Teaching Assistants

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Office Hours</th>
<th>Office Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>homework grader</td>
<td>Josh Perkins</td>
<td>Tue. 1:00PM – 2:00PM</td>
<td>EL L220</td>
</tr>
<tr>
<td>homework grader</td>
<td>Sourav Sanyal</td>
<td>Mon. 11:00AM – 12:00PM</td>
<td>SANT building, RM. 301A, Bridge Lab</td>
</tr>
<tr>
<td>homework grader</td>
<td>Abrar Zahin</td>
<td>Thu. 11:30AM – 1:00PM</td>
<td>EL L220</td>
</tr>
<tr>
<td>lab TA</td>
<td>Gavin Gray</td>
<td>Mon. 12:00PM – 1:00PM</td>
<td>EL 120</td>
</tr>
<tr>
<td>lab TA</td>
<td>Alex Mattinson</td>
<td>Tue. 11:30AM – 12:30PM</td>
<td>EL 105</td>
</tr>
<tr>
<td>lab TA</td>
<td>Sterling Wall</td>
<td>Fri. 12:30PM – 1:30PM</td>
<td>EL 120</td>
</tr>
<tr>
<td>lab TA</td>
<td>Rejoy Matthews</td>
<td>Thu. 12:00PM – 1:00PM</td>
<td>EL 105</td>
</tr>
<tr>
<td>lab TA</td>
<td>Rakin Sadab</td>
<td>Wed. 12:00PM – 1:00PM</td>
<td>EL 105</td>
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#### Course Description

- Teaches the fundamental theory and design methods for digital systems.
- Topics include:
  - Introduction to logic circuits
  - Number representations and arithmetic circuits
  - Combinational-circuit building blocks
  - Flip-flops, registers, and counters
  - Synchronous sequential circuits
  - Digital system design
  - Optimized implementation of logic functions
  - CAD tools and testing
- Labs will design digital systems using Verilog *hardware description language* (HDL) and *field programmable gate arrays* (FPGAs).

#### Course Objectives

This course introduces you to the design of digital systems. At the conclusion of this course, you are expected to be able to
• understand Boolean algebra;
• design complex combinational and sequential circuits;
• understand the concept of finite state machines and high-level state machines; and
• use a hardware description language (Verilog) to design circuits.

IDEA Objectives

At the conclusion of this course, you will

• Learn fundamental principles, generalizations, or theories.
• Gain factual knowledge.
• Learn to apply course materials.

Prerequisites

CS 1400 Introduction to Computer Science - CS1.

Textbook


Supplemental material may be provided and made available on Canvas or in your lab sessions.

Lab Kit and Software

• **Hardware**: You should check out or purchase a Digilent Basys 3 FPGA board from the ECE Store (EL104).

• **Software**: Vivado Design Suite, version 2015.4
  
  – All labs require this software tool, which is install on the lab machines in EL 105 and EL 120.
  
  – Free student versions for home use are available for Windows and Linux. Get the _2015.4 WebPACK_ version. If you use Mac OS X, you can run Vivado using a virtual machine application like Parallels, but this takes some extra time to setup.
Lectures

Lectures will cover the most important and difficult parts of the course material. You are expected to read relevant sections of the textbook prior to lecture.

Exams

There are three exams. The exams will cover all of the material presented in lecture and all the material in the text specified in the study guides to be handed out throughout the course. For each exam, unless instructed otherwise you are allowed one double-sided 8.5 × 11 note sheet and a calculator.

Labs

Pre-lab preparation is required for all labs, and must be completed before the lab session. Pre-lab work includes reading the entire lab assignment. Any written pre-lab exercises must follow the homework format. The lab TA will check and grade each lab for both preparation and completion. There is a 10% penalty if the preparation work is incomplete at the beginning of the lab period. Students not performing all of the lab work or the final project will fail ECE 2700, even if you earn a passing total score. You cannot have any zeros on lab assignments or the final project.

Homework Assignments

You are required to submit the scanned images of your homework assignments on Canvas. They must clear and readable. Grades and feedback will be provided through Canvas.

Building Opening Hours

The buildings and labs are scheduled to be open at the following times:

- Weekdays: 6am - 12am (Midnight)
- Weekends: 7am - 10pm
- Holidays: Closed

Tutoring

The College of Engineering has an Engineering Tutoring Center. Tutoring services are available free of charge to all College of Engineering students. You can find help for any engineering required courses, i.e., math, chemistry, physics, and all engineering classes. The Tutoring Center is located in ENGR 322 and 324. Hours are Monday through Friday 8:00 am to 5:00 pm with extended hours on Tuesday and Thursday until 7:00 pm.
Late/Missing Work

• Lab assignments: There is a 10% penalty for each week lab work is not completed by the due date. Late work is accepted up to two weeks after the due date. Work turned in after that time will not be accepted.

• Homework assignments: They are due by their stated due time on the due date. Late submissions are accepted up to 72 hours after the due date. After the due date, you will lose 25% of your score for every 24 hour period.

• The make-up for late/missing homework or lab assignment submissions is granted only when a verifiable proof such as a police report or a doctor’s note showing some emergency is presented to the instructor.

Grading Weights

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Grade</th>
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<tbody>
<tr>
<td>Homework Assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Lab assignments</td>
<td>25%</td>
</tr>
<tr>
<td>First Midterm Exam</td>
<td>10%</td>
</tr>
<tr>
<td>Second Midterm Exam</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Final Project</td>
<td>15%</td>
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Grading Scale

The grading scale below may be subject to minor changes at the end of the semester.

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
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<tbody>
<tr>
<td>92.50% - 100%</td>
<td>A</td>
</tr>
<tr>
<td>89.50% - 92.49%</td>
<td>A−</td>
</tr>
<tr>
<td>85.50% - 89.49%</td>
<td>B+</td>
</tr>
<tr>
<td>82.50% - 85.49%</td>
<td>B</td>
</tr>
<tr>
<td>79.50% - 82.49%</td>
<td>B−</td>
</tr>
<tr>
<td>75.50% - 79.49%</td>
<td>C+</td>
</tr>
<tr>
<td>72.50% - 75.49%</td>
<td>C</td>
</tr>
<tr>
<td>69.50% - 72.49%</td>
<td>C−</td>
</tr>
<tr>
<td>65.50% - 69.49%</td>
<td>D+</td>
</tr>
<tr>
<td>62.50% - 65.49%</td>
<td>D</td>
</tr>
<tr>
<td>59.50% - 62.49%</td>
<td>D−</td>
</tr>
<tr>
<td>≤ 59.49</td>
<td>F</td>
</tr>
</tbody>
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Policy for Regrading

If you have a question regarding your grade, please contact the instructor or TA(s) who graded the problem in question to address the issue. All assignments and exams are assumed to be correctly graded one week after they are returned. After the one week has lapsed, no changes will be considered.
Course Communication

Canvas will be used for course materials including lecture slides, related course materials, downloading assignments, submitting assignments, and checking your grades.

You should frequently check updates on Canvas and make sure your email inbox is cleared because messages broadcast to the whole class will be sent out via announcements and/or emails. You are responsible for not receiving emails due to the overflow of your email inbox.

Academic Integrity/Academic Dishonesty

Students are expected to be honest and not cheat on their assignments/examinations/project. Collaboration and discussion with fellow students are encouraged, but cheating will not be tolerated in this course. Cheating includes but is not limited to:

- Copying code from resources on the Internet.
- Copying homework answers on the Internet.
- Copying someone else’s assignment or code, or allowing another student to copy yours.
- Making solutions to a homework or lab assignment or a project available to others.
- Examining or using solutions from previous years’ classes.
- Using the instructors solution manual for this class’s textbook.

Use your common sense. Anything that gives you an unfair advantage over other students is likely considered cheating.

Cheating will not be tolerated in this course. The first offense results in a zero on the assignment, project, or exam. The second offense results in a failure (grade of “F”) for this course.

General Policies

- Class attendance is required although not actively monitored. Students are responsible for obtaining all information communicated in classes. The information covered may not be necessarily duplicated on the course webpages.

- Academic dishonesty will not be tolerated and the student, in question, will be dealt with in accordance with the University policies. Full text of the Student Code are available at http://www.usu.edu/studentservices/studentcode/.

- Students are not allowed to sell or distribute notes provided for this class.
• Students with disabilities are encouraged to consult the instructor and the Disability Resource Center (DRC) as soon as possible. Please inform the instructor if there is a need for alternate format for documents or notetaker. DRC Statement: “Students with ADA-documented physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations. Veterans may also be eligible for services. All accommodations are coordinated through the DRC (https://www.usu.edu/dry/) (435)797-0359.”

• Students who anticipate the necessity of being absent from class due to the observation of a major religious observance must provide notice of the date(s) in writing by the second class meeting.

• The instructor reserves the right to interpret the class policies if confusions may occur.