

EECS 140/141 Lab Syllabus

Introduction to Digital Logic Design – Fall 2022

1. General Information

Teaching assistant: Sharmila Raisa

Office hours: Refer Wiki Link below. **Office Location:** Eaton 3011 (Email First)

Email: sharmila@ku.edu

Lab points: 20 course points towards 140/141 grade

Lab website: https://wiki.ittc.ku.edu/ittc_wiki/index.php/EECS_140_Lab

Optional text: Digital Design Using Digilent FPGA Boards 2nd edition by Richard E. Haskell and Darrin M. Hanna

2. Lab Objectives

To introduce the students to digital design software (Vivado) and learn to design digital logic using schematics or by writing VHDL code, simulate designs using test bench waveforms, and implement circuits on actual hardware.

To learn basics of through-hole soldering and get hands-on experience of building/testing simple circuits using 7400 series ICs on a PCB.

3. Honors Section

EECS 141 is the Honors section of EECS 140. Some of the lab exercises for EECS 141 will be more challenging than for EECS 140.

4. Lab Schedule (tentative)

VHDL Introduction Labs (3 labs)

Lab 1: Introduction to FPGA programming with Vivado

Lab 2: Introduction to VHDL

Lab 3: Implementation of nuclear power plant control circuit

PCB; soldering and build/test circuits (4 labs)

Lab 4: Introduction to prototype board

Lab 5: Implementing a SOP Expression on Prototyping board

VHDL design (6 labs)

Lab 6: 7-Segment Display

Lab 7: Introduction to Structural VHDL models

Lab 8: Four-Bit Adder with Double 7-Segment Display

Lab 9: Arithmetic Logic Unit

Lab 10: Scrolling Display

Lab 11: Decoder and Encoder

Lab 12: Latches, Flip-Flops and Registers

5. Lab Grading

We will have 12 to 13 labs during the semester. Each lab is worth 100 points. The breakdown of the 100 points is below;

Lab report:	50 points, <i>due 5 mins into the next lab</i>
Experiment:	35 points, <i>0 points if not confirmed by GTA</i>
Pre-lab/quiz:	15 points, <i>due 5 mins into the next lab</i>

There is an overall 5% grade for participation.

6. Responsibilities

- Your lab reports and pre-lab work will be due at the **beginning** of the following lab.
- Lab attendance is **required**, come to your section. **Make-up labs** will be considered only if I am informed in **advance** of the lab time via email. If the reason is illness, I **require documentation** of the illness from a health-care professional. This documentation can be provided after the lab.
- The lab will be open exclusively during the scheduled times. You may not work on labs at any other time.
- **No food or drinks** allowed in the lab as per EECS dept requirements
- Show up on time, extra time will not be allowed for those that show up late
- You should work on the lab and report individually.

7. Academic Misconduct

Students are encouraged to study together but cheating will be dealt with severely. Cheating includes, but is not limited to, copying answers for the lab report/pre-lab work, using somebody else's VHDL code/screenshots, having another student do your work for you, falsifying (or using another individual's) data or misrepresenting procedures used during labs, etc. If you are ever in doubt about what level of collaboration is acceptable, contact me.

8. Lab report format

In general, your lab report should consist of the following sections:

1. **Cover page**
2. **Introduction and Background**
3. **Implementation process**
4. **Evaluation process**
5. **Results and discussion**
6. **Conclusion**

PreLabs: Every prelab is due 5mins into the Lab. You can find prelab/quiz questions on wiki page of respective labs. Ex: Prelab 1 under Lab 1, Prelab 02 under Lab 2 so on.

NOTE: Follow the lab report format as explained. And submit a printed report, preferably back to back and printed Pre-labs (Boolean circuits can be hand written, use Stencil) stapled together.

Sample Lab Report: Next page

EECS 140: Lab 1 Report

Introduction to Vivado and VHDL

Your Name

KUID: Your KU ID

Date submitted: 08/28/2022

1. Introduction and Background (5 points)

- Introduction: This is a highly condensed summary (2-3 sentences) of the purpose of the experiment and how it fits with lecture or previously done labs.
- Background: This is necessary additional information crucial to understanding the experiment. An example would be how to read the value of a resistor or how a transistor works. This section usually discusses how any new components in the experiment work.

2. Implementation Process (15 points)

What did you do in this lab?

Here you summarize the process used to create/set-up the experiment, with an explanation of such process, equipment, concepts and materials you used. For software based labs, this would be the place to explain the various steps involved in your design/simulation. If this is lengthy, condensed bullet points are your friends. **Do not repeat the instructions, you're not writing lab instructions** (that's what we do), you are writing a lab report.

Note: This is where you include copy of the code/screenshot/photo of the design

3. Evaluation Process (5 points)

How do you know what you did is correct?

Describe testing procedures to measure/evaluate the correct behavior of your experiment; including what information you need to gather and how you will measure it.

Note: This is where you include if you faced any errors and how you fixed it

4. Results & Discussion (20 points)

- This is the main section of the report. However, **presenting results ("It worked") without an appropriate explanation does not show thorough understanding of the material.** Hence, the results will only count for 5 points, while the Discussion will have a 15 point value. Discussion includes why the experiment did or did not work in accordance to what you described in the evaluation process, how the experiment performed, its measurements and results. In essence, what do the results mean?
- *Note: If the lab experiment required you to write a program, the discussion section must state how the program functions.*

5. Conclusions and Recommendations (5 points)

The final section indicates what you learned from the project, comments on the results you obtained, and future work (next week's lab). You can combine results, discussion & conclusions section as you see fit.

NOTE: Anywhere you include a screenshot/photo/code, make sure you label it (Ex: *Fig1: Snippet of code used for implementing clock divider*) right below the screenshot/photo/code.