

Fort Lewis College
(Computer Engineering)

COURSE SYLLABUS

ENGR 338: Digital VLSI Design

4 Credits

(Lectures/Labs)

Land Acknowledgement: "We acknowledge the land that Fort Lewis College is situated upon is the ancestral land and territory of the Nuuchiu (Ute) people who were forcibly removed by the United States Government. We also acknowledge that this land is connected to the communal and ceremonial spaces of the Jicarilla Abache (Apache), Pueblos of New Mexico, Hopi Sinom (Hopi), and Diné (Navajo) Nations. It is important to acknowledge this setting because the narratives of the lands in this region have long been told from dominant perspectives, without full recognition of the original land stewards who continue to inhabit and connect with this land. Thank you for your attention and respect in acknowledging this important legacy."

1. Professor:

Yiyan Li: BH601, yli@fortlewis.edu

Office Hours: 8/28/2023 - 12/8/2023, Mon - Thu 2:20 - 3:20 pm in BH 601.

Make an appointment if you need a face-to-face meeting outside office hours. (simply shoot me an email to check my availability).

Lectures:

Time: MWF 11:15 am – 12:10 pm (8/28/2023 – 12/9/2023)

Location: SFH711

Labs:

Time: T 8 – 11:05 pm

Location: SFH2771

Course Description

This course introduces semiconductor physics, the semiconductor industry, and the design, layout, and simulation of digital integrated circuits. Students will learn MOSFET operation in the integrated circuit level and will be able to build digital circuit blocks such as adders, subtractors, MUXes, and flip-flops in a physical integrated circuit layout tool. Students will learn the skills of minimizing the layout area of the circuits and reducing the time delay of the circuits. In the labs, students will build digital blocks using the C5 technology and integrate the digital blocks into a pad frame for fabrication.

Course Materials & Resource

CMOS Circuit Design, Layout, and Simulation, Third Edition, R. Jacob, Baker. (required)

CMOS VLSI Design: A Circuits and Systems Perspective 4th Edition, Neil Weste, David Harris. (Optional).

Course Topics

Review of circuit analysis theories

Semiconductor Basics

ADC/DAC Basics

The N Well

C5 Layers

Active and Ploy Layers

Models for Digital Design

Static Logic Gates

Bipolar Junction Transistors

MOSFETs

The Semiconductor Industry, Yield, and Defects

Memory Circuit Design

Grading Policies

20% Homework/Quizzes

20% Midterm

20% Lab Reports

10% Project

30% Final

Grading Scale by %:

Letter Grade/Point Range

A 93-100

A- 90-92

B+ 87-89

B 83-86

B- 80-82

C+ 77-79

C 73-76

C- 70-72

D+ 67-69

D 63-66

D- 60-62

F 0-59

Course Outcomes

After completing ENGR 338 students will be able to:

List the main layers used in the fabrication of a digital integrated circuit. (1, 6)

Sketch the cross-sectional view of a layout. (6)

Design combinational and sequential logic circuits. (1, 2, 6)

Discuss the movement of electrons and holes in pn-junctions and transistors under various operating conditions. (1)

Calculate delays through semiconductor materials and conducting wires. (1)

Layout digital circuits and chips. (1, 6)

Engineering Program Student Learning Outcomes (ABET criteria)

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Policies

Attendance

Attendance is defined to be: in class on time, in class for the duration of the class period, prepared for the day's topic, participation in class.

Disenrollment Policy

You will be disenrolled from this course if you miss the first day of class and the first laboratory session. If you are disenrolled from the class, you may re-register if space is available.

Course Withdrawal Information

Withdrawal from Course – See Registrar's Office website. The date is a college-wide deadline that is not negotiable.

To withdraw from this course, go to the Registrar's Office, Room 160, Miller Student Services Building before the course withdrawal deadline. They will help you through the process. You do not need my signature on the course withdrawal request form.

Starting Fall 2013, students have a lifetime limit of three individual course withdrawals from FLC courses. If you have withdrawn from classes before Fall 2013, these will not count towards your lifetime limit. Also, withdrawing entirely from a semester (all classes) does not count against your lifetime “CW” limit. Semester withdrawal is handled under a different policy and procedure. Please refer to the Academic Policies section of the Fort Lewis College Catalog of Courses for more information about the course and semester withdrawal policies and procedures.

Canvas

Online materials (lecture notes, homework assignments, quizzes) will be available at Canvas or on the professor’s course webpage. If you are not familiar with Canvas, please work through the Student Canvas Orientation. For technical help with Canvas contact the 24/7 support hotline at 855-971-1611 or submit a HELP ticket in Canvas.

Course Expectations

Credit Hour Syllabus Statement

In addition to spending 3 hours per week attending class, the typical student in this 4 credit lecture course/labs should expect to spend at least 6 hours per week of concentrated attention on course-related work, including but not limited to time spent reading, reviewing, organizing notes, preparing for upcoming quizzes/ exams, problem solving, developing and completing projects, and other activities that enhance learning.

Academic Integrity

Academic dishonesty includes all forms of unethical or illegal behavior which affects a student’s academic standing, including, but not limited to, cheating on exams, plagiarism, forgery of academic documents, falsification of information on academic documents, or unauthorized access to computer files containing academic information. Academic dishonesty may result in sanctions ranging from a lowered grade on a particular assignment to an “F” in the class and report submitted to the Office of the Vice President of Academic Affairs.

****"Fort Lewis College is committed to providing all students a liberal arts education through a personalized learning environment. If you think you have or you do have a documented disability which will need reasonable academic accommodations, and/or if you are a Veteran who may need services, please contact the Disability Services Office, 280 Noble Hall, 970-247-7383, disabilityservices@fortlewis.edu for an appointment as soon as possible.”

FLC students may be eligible for SNAP benefits. Please contact Marissa Hunt, *Resource Center Manager* at Manna. 970-385-5095, ext. 3, or email: services@mannasoupkitchen.com.

In addition, the [FLC Grub Hub](#) is a student-led, food justice organization committed to serving students and their families by sharing free food for all. Please come visit the Grub Hub in their new location in the Student Union across from the post office to learn more.

Reach Out for Success Statement:

College students encounter setbacks from time to time. If you encounter difficulties and need assistance, it's important to reach out. Consider discussing the situation with an instructor, academic advisor, peer support office, or counselor. Learn about resources that assist with wellness and academic success at: <https://www.fortlewis.edu/life-at-flc/student-services/student-affairs/student-affairs-home>

If you or someone else is in immediate crisis, please call the local 24-hour crisis hotline (970) 247-5245, call the Colorado 24-hour crisis hotline (844) 493-8255, text "TALK" to 382555, or call the FLC Counseling Center during regular business hours (970) 247-7212.

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Students as Parents Statement:

I am aware that it can be challenging to be a parent while enrolled in college courses and want to support parents to successfully pursue their education. If you are unable to attend class due to children's illnesses or unforeseen disruptions in childcare, please contact me.