
SYLLABUS PART ONE:

Course Title and Course Number: ECE 4590/6590 Integrated Circuit Design

Term: Fall 2023

Class Meeting Time and Place: Riggs 226

Time to Wait: Every attempt will be made to announce class cancellations in advance. A time for make-up lectures will be determined. Students may leave after 15 minutes if no one shows up to teach a class.

Information on Modality: in-person

Instructor Name: Yingjie Lao

Instructor Email: ylao@clermson.edu *I do my best to respond to email inquiries within 24 hours, excluding weekends and university holidays.*

University Office Phone: 864-656-5931

Office Address/Office Number: Riggs 313B

Student Hours: After class or by appointment. *During the student hours, I look forward to the opportunity to discuss course concepts, assignments, or any other items that you would like to talk about. I design this time to get to know you and welcome you to join me for casual conversations about the course and life in general.*

Course Description:

Design concepts and factors influencing the choice of technology; fundamental MOS device design; silicon foundries, custom and semicustom integrated circuits; computer-aided design software/hardware trends and future developments; hands-on use of CAD tools to design standard library cells; systems design considerations, testing, and packaging.

Prerequisites:

Students are expected to have completed a course comparable to ECE 3210 before enrolling in this course. Additionally, students are expected to have completed, or be concurrently enrolled in, a course comparable to MATH 3110 or MATH 4340 when enrolling in this course. Coreq: ECE 4591/6591.

Learning Objectives / Outcomes:

At the completion of the course, students should be able to understand the transistor-level and logic-level aspects of integrated circuit (IC), and design digital VLSI circuits. Besides, students should be familiar with Cadence Computer-Aided Design (CAD) tools that are the de-facto design software in the semiconductor industry.

Required Materials

N. Weste and D. Harris, "CMOS VLSI Design", Addison-Wesley/Pearson, 4th edition, 2011. ISBN: 0321547748.

RECOMMENDED MATERIALS:

J. M. Rabaey, "Digital Integrated Circuits: A Design Perspective", Prentice-Hall, 2nd edition, 2003, ISBN: 0130909963.

S. Kang and Y. Leblebici, "CMOS Digital Integrated Circuits", McGraw Hill, 4th edition, 2014. ISBN: 0073380628.

Student is required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a scanner, and a cell phone.

Topical Outline (subject to change):

- IC Design Flow (1 week)
- CMOS Device Physics and Models (2 weeks)
- Basics of CMOS Circuits: Basic Gates, Combinational and Sequential Logic (3 weeks)
- Delay Calculation and Optimization (1.5 weeks)
- Designing Wires (1.5 weeks)
- Dynamic Styles: Domino and Pass Transistor Logic (1.5 week)
- Logic Design: Adders and Multipliers (2 weeks)
- SPICE Simulation (2.5 weeks)

Assessment

Major Assessment/Grading Activities:

All exams are closed book/notes. But one A4 (8.5x11) sheet of hand-written notes is allowed. The notes must be turned in after the exam. The details will be announced on Canvas.

- Homework: 20% (~4 assignments)
- Quiz: 4590: 15% 6590: 10%
- Lab: 4590: 25%, 6590: 30% (graduate students are required to complete a larger project)
- Midterm 1: 20%
- Midterm 2 (Cover the materials after Midterm 1): 20%

Grading System:

Letter	Points/Percentages
A	85-100%
B	75-85%
C	65-75%
D	60-65% (4590)
F	<60% (4590) <65% (6590)

I reserve the right to curve test scores in situations that I deem warrant such. Curving test scores is NOT a given.

Attendance: Attendance is optional but is highly recommended. However, participation provides unique opportunities to learn from your peers and myself. Therefore, attendance in class is important. In addition, you won't miss the quizzes!

Grading Policies:

I will not round up the grades. The expected turnaround time for grading is 1 week.

Late Work: No late submission will be accepted, unless there is a compelling reason.

Your Well-being is Important

As a student you may experience a range of personal issues that can impede learning, such as strained relationships, increased anxiety, alcohol/drug concerns, feeling down, sadness, difficulty concentrating, lack of motivation, or other issues. These mental health concerns may impact your academic performance or your participation in daily activities. It is very important that you ask for help when you are struggling. Please reach out to me or to Clemson's [mental health services](#) to guide you to resources that will help.

Other Policies:

1. You are responsible for all assigned readings and information presented in class and on class Canvas site, including important announcements, due dates, assignments, exams and so forth.
2. Cheating of any kind is extremely serious and may result in a course grade of F and/or expulsion from the University.
3. Discussion is ok, but plagiarism is not. You can discuss homework, labs or projects with your colleagues but the solutions you turn in must clearly be your own.
4. Collaboration on exams is NOT ok!
5. No "Incomplete" grades will be given for the class, except under verifiable extraordinary circumstances.
6. Any student who disagrees with the grading of a homework assignment, project, or exam must contest the grading within one week of the date on which the graded material is returned to the class. This must be done by returning the original graded material to the instructor accompanied by a written description of the student's disagreement that is sufficiently detailed to allow accurate consideration of the claim.
7. You are not permitted to submit extra work in an attempt to raise your grade.
8. Exams must be taken on the date and time as scheduled. A student absent from a test will receive a grade of 0 for that test. In case of compelling reasons (as judged by the instructor), the instructor will make an effort to accommodate the student, but this should be a last resort. Note: valid excuses MUST be presented to the instructor before or within three days of the missed test or exam. No exceptions will be accepted. Any exam that was scheduled at the time of a class cancellation will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the cancellation.

Notification of Absence:

The **Notification of Absence module in Canvas** allows students to quickly notify instructors (via an email) of an absence from class and provides for the following categories: court attendance, death of immediate family member, illness, illness of family member, injury, military duty, religious observance, scheduled surgery, university function, unscheduled hospitalization, other anticipated absence, or other unanticipated absence.

The notification form requires a brief explanation, dates and times. Based on the dates and times indicated, instructors are automatically selected, but students may decide which instructors will receive the notification. This does not serve as an “excuse” from class. It is a request for an excused absence and students are encouraged to discuss the absence with instructors, as the instructor is the only person who can excuse an absence. If students are unable to report the absence by computer, they may reach the Office of Advocacy and Success.

Students with excessive absences who need academic or medical assistance can also contact the Office of Advocacy and Success.

Inclement weather or emergency: Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless I contact you otherwise. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless I contact you. And any extension or postponement of assignments or exams must be granted by me via email or Canvas within 24 hours of the weather-related cancellation.

STANDARD ACADEMIC POLICIES

Academic Integrity

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

All infractions of academic dishonesty by undergraduates must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism instructors may use the Plagiarism Resolution Form.

See the [Undergraduate Academic Integrity Policy](#) website for additional information and [the current catalogue](#) for the policy. For graduate students, see the current [Graduate School Handbook](#) for all policies and procedures.

Accessibility

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing studentaccess@lists.clemson.edu, or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen, if at all possible, but there could be a significant wait due to scheduled appointments. Students who have accommodations are strongly encouraged to request, obtain and send these to their instructors [through the AIM portal](#) as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester.

You can access further information at the [Student Accessibility website](#). Other information is at the university's [Accessibility Portal](#).

The Clemson University Title IX Statement Regarding Non-Discrimination

The Clemson University Title IX statement: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This [Title IX policy](#) is located on the Campus Life website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 223 Brackett Hall, 864-656-0620. Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

Clemson University aspires to create a diverse community that welcomes people of different races, cultures, ages, genders, sexual orientation, religions, socioeconomic levels, political perspectives, abilities, opinions, values and experiences.

Emergency Preparation

Emergency procedures have been posted in all buildings and on all elevators. Students should be reminded to review these procedures for their own safety. All students and employees should be familiar with guidelines from the Clemson University Police Department. [Visit here](#) for information about safety.

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

1. Ensure you are signed up for [emergency alerts](#)
2. Download the [Rave Guardian app](#) to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
3. Learn what you can do to [prepare yourself](#) in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

MODIFICATION STATEMENT: The instructor reserves the right to modify any aspect of the syllabus at any time during the semester. Updated version will be posted on Canvas. The date of this version of the syllabus is August 23, 2023.