CSE 493/593 Introduction to VLSI Electronics Fall 2025

Instructor: Professor R. Sridhar, E-mail: rsridhar@buffalo.edu Office Hours: Wednesday 1:00-3:00pm 338K Davis Hall

Teaching Assistants: Aryan Pandey; Email: aryanpan@buffalo.edu;
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Off. Hours: During the Lab hours

Lecture: Wednesday 6:30 PM - 9:00 PM **Talbert** 107

Scheduled Lab Hours: A1: Monday 5:00pm-7:00pm A2: Tuesday 7:00pm-9:00pm 340 Bell Hall

Course Objectives:

This is an introductory course in VLSI Systems and Design. At the completion of this course, a student should be able to design and analyze digital systems, incorporating into a VLSI chip. They should be able to design for low power and design for performance, work in small groups and bring together design components into a full custom chip.

Topics:

- Introduction to VLSI; design metrics
- MOS Devices, CMOS Inverter
- Combinational logic, layout, design rules
- Manufacturing process;
- Simulation; CAD tools
- Low Power design strategies
- CMOS inverter - the dynamic view
- Logic Styles; Dynamic CMOS logic
- Timing and clock synchronization, pipelining
- Static, Dynamic sequential circuits
- Deep sub-micron designs; design for performance
- Wires; Coping with Interconnects
- Adders, Multipliers, data paths; timing issues
- Memory structures
- Emerging topics; Variability and Design for Manufacturing
- CMOS system design, Floor plan, Placement and routing, Project design

Learning Outcomes:

By completing this course, the students are expected to have obtained

- the knowledge of fundamentals of VLSI Design principles
- experience of designing a full custom Integrated circuit chip working in a design team
- skills to communicate their design experience through a detailed report and a short presentation to the class

Text Book:

- Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic. Second Edition, A Prentice-Hall, 2003

Reference Books:

- Digital VLSI Chip Design with Cadence and Synopsys CAD Tools, Eric Brunvand, Addison Wesley, 2009
- CMOS VLSI Design: Circuits and Systems Perspective, by N Weste and D. Harris, Fourth edition, Addison Wesley, 2010

Course Grading:

Project (Completed project, reports, demonstration and presentation) = 35 points; Quiz = 5 points (2,2,1) Lab = 8 points; Exam 1 = 20 points; Exam 2 (cumulative) = 30 points

Grade Assignment: (Letter grades carry normal numerical values)

(90-100 = A, 88-89 = A-, 86-87 = B+, 80-85= B, 77-79 = B-, 75-76 = C+, 70-74 = C, 65-69 = C-, 60-64 = D, 1-59 = F). **A passing grade must be obtained in each of the following components: a) design project and lab work combined and b) quiz and the exams combined, to get a passing grade in this course.**

Curving will be applied as deemed appropriate by the instructor. Design of a full custom, fully verified VLSI chip is required. No makeup quizzes will be given. Homework is not collected or graded.

Grades for CSE493 will be determined considering only CSE493 students and similarly for CSE593.

Academic Integrity: All work submitted for CSE 493/593 must be your own and must be done on an individual basis. We have zero tolerance on cheating (Quiz, project, or exam), which will result in automatic failure of the course.

We will follow CSE Department Policies on Academic Integrity.

It is your responsibility to read these policies and penalties. Class Participation: Class participation is strongly encouraged.

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