

USCViterbi

**EE 477L - MOS VLSI Circuit Design**

**Units: 4**

**Term—Day—Time:**

**Fall 2024**

**Lecture:**

**Discussion:**

**Location: DEN**

[Classes Offered · USC Schedule of Classes](#)

**Instructor: Shahin Nazarian**

[shahin.nazarian@usc.edu](mailto:shahin.nazarian@usc.edu)

**Office: EEB 340, Office Hours: TBA**

Note: This syllabus will be updated by the first day of the semester.

### Catalogue Course Description

This course provides an introduction to analysis and design of digital MOS VLSI circuits including area, delay and power minimization. The course explores the design aspects involved in the realization of CMOS integrated circuits from device up to the register level. The course includes the study of the MOS devices, logic cells, and critical interconnect and cell characteristics that determine the performance of VLSI circuits. Students will use CAD tools to develop efficient circuit layouts and verify designs. Laboratory assignments include design, layout, extraction, and simulation. As part of the final project students design a full-custom FSM.

### Learning Objectives

The main goal of this class is to practice at least part of the ASIC full-custom design flow, from specification down to layout, and develop the necessary hardware and software skills for it. In addition to design steps, the flow includes optimization and verification steps and they are partly practiced in this course. We will also cover the basic concepts of the CMOS technologies.

**Prerequisite(s):** EE 338 or EE 354.

**Co-Requisite(s):** none

**Concurrent Enrollment:** none

**Recommended Preparation:** none

### Required Readings and Supplementary Materials

**CMOS Digital Integrated Circuits, 4th edition, Kang, Leblebici and Kim, McGraw-Hill**

### Grading Breakdown

Assignment	Points
Home Works	6
Labs	12
Final Project	22
Mid Term Exam	30
Final Exam	30
<b>TOTAL</b>	<b>100</b>

### Assignment Submission Policy

Assignments are assigned weekly and due in class the following week. Programming projects and mininet exercises are explained and assigned in discussion section.

## Course Topics

- Logic design fundamentals
- MOS theory
- MOS fabrication
- Layout design
- Static analysis
- Transient analysis
- Super buffer and ring oscillator design
- Interconnect modeling
- Transistor level design and optimization using various styles including CMOS
- Power dissipation
- Sequential logic design
- Dynamic circuits
- Memory basics

## Statement on Academic Conduct and Support Systems

### Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://adminopsnet.usc.edu/department/departement-public-safety>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

### Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/alj>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* [http://sait.usc.edu/academicssupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicssupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which

instruction will be continued by means of blackboard, teleconferencing, and other technology.