

**EECS 170D INTEGRATED ELECTRONIC CIRCUIT DESIGN**  
(Elective for CpE and EE)

- Catalog Data:** **EECS 170D Integrated Electronic Circuit Design (Credit Units: 4)**  
Overview of design and fabrication of modern digital integrated circuits. Fabrication of CMOS process; transistor-level design simulation, functional characteristics of basic digital integrated circuits, different logic families including static and dynamic logic, layout and extraction of digital circuits; automated design tools. Prerequisites: EECS170C and EECS170LC. Formerly ECE113D. (Design units: 4)
- Textbook:** Rabaey, Jan M., Chandrakasan, Anantha, and Nikolic, Borivoje, *Digital Integrated Circuits: A Design Perspective*, 2<sup>nd</sup> edition, Prentice-Hall, 2003.
- References:** Gray, P. R., Hurst, P. J., Lewis, S. H., & Meyer, R. G., *Analysis and Design of Analog Integrated Circuits*, John Wiley & Sons, 2001.
- Coordinator:** Payam Heydari and Ahmed Eltawil
- Course Objectives:** To understand the steps involved in the fabrication of a CMOS microelectronic circuit.  
To understand the functional characteristics of basic digital integrated circuits and different logic families including the static and dynamic logic.  
To be able to design and simulate various functional blocks utilized in CMOS digital integrated circuits. Such blocks include: combinational and sequential logic blocks (both static and dynamic styles); and differential pairs.  
To understand how to perform physical layout of basic functional circuit blocks that have been designed.
- Course Outcomes:** Students will:  
Describe the actual steps involved in the fabrication of a CMOS integrated circuit.  
Describe the functional characteristics of basic digital integrated circuits and different logic families including the static and dynamic logic.  
Design and simulate various functional blocks utilized in CMOS digital integrated circuits. Such blocks include: combinational and sequential logic blocks (both static and dynamic styles); and differential pairs.  
Perform physical layout of basic functional circuit blocks that have been designed.
- Prerequisites By Topic:** Understanding of engineering materials at the EECS70A/B, a sophomore-level course.  
EECS 170A, Electronics I which covers basic semiconductor device principle.  
EECS 170B, Electronics II.  
EECS 170C, Electronics III which covers operation, design, and utilization of integrated circuit modules, including operational amplifiers.
- Lecture Topics:** The course is aimed at providing a comprehensive overview on the

analysis, design, and simulation of CMOS digital integrated.

**Class Schedule:** Meets for 3 hours of lecture and 2 hour of discussion each week for 10 weeks.

**Computer Usage:** Typical programs include: HSPICE on UNIX or PSPICE on PC, MAGIC layout on UNIX, and IRSIM on UNIX.

**Laboratory Projects:** Varies on a quarterly basis, an example is designing a 5-GHz frequency divider in a 0.18 $\mu$ m CMOS technology.

**Professional Component:** Contributes toward the Computer Engineering Topics Courses and Electrical Engineering Topics Courses and Major Design experience.

**Relationship to Program Outcomes:** This course relates to Program Outcomes a, c, d, e, I, j, and k as stated at:

<http://undergraduate.eng.uci.edu/degreeprograms/electrical/mission>

### Design Content Description

**Approach:** The class material involves analysis, simulation, and design of CMOS digital integrated circuits. The design component is highly emphasized through the selection of lecture material, homework, and term project. The lecture material is closely related to the homework assignments which are prepared with a design perspective. Homework will contain problems related to CAD. In term project students must design and layout an advanced circuit that will be defined during the course.

**Lectures:** 100%

**Laboratory Portion:** 0%

### Grading Criteria:

Home work:	10%
Midterm exam:	25%
Project:	24%
Final exam:	40%
Survey:	<u>1%</u>
	100%

### Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%

Engineering Science: 0 credit units or 0%

Engineering Design: 4 credit units or 100%

**Prepared by:** Ahmed Eltawil, Payam Heydari **Date:** July 2007

**CEP Approved:** Fall 2004