

ECE534 Analog IC Design

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Credits:

	Lecture	Lab	Other	Total
Credit Distribution	3	1	0	4
Clock Hour Distribution	3	3	0	6

Prerequisites:

The prerequisites for this course are ECE312 and ECE332.

Course Description:

This course covers the topic of some of the advanced topics of analog IC design beyond what is covered in ECE332 (Electronics II). With VLSI processing technologies becoming more and more complex in terms of process variations and the design of high performance, low power, and low noise analog ICs becomes increasing difficult. This course is intended to introduce students with the concept of designing and analyzing analog circuits under the influence of various technology imperfections. The topics this course will cover include:

1. Review of CMOS process technologies and sources of process variations,
2. Amplifier designs in terms of performance, power, and noise tradeoffs,
3. Reference circuit design,
4. Switched-capacitor circuits,
5. Noise analysis and design for low noise,
6. Analog IC layout, and
7. Some applications of analog circuits in sensors and communication systems.

Detailed Course Outline (Week-by-Week)

Following is a tentative course outline. It is subject to change depending on progress in class instruction and the design project.

Week Lecture Topics and Lab Contents

- 1,2: Review of CMOS process technologies, sources of process variations, and their impact on analog circuits
3,4: Practical biasing techniques for analog circuits
5,6: Reference circuit design
7,8: Amplifier settling time, doublets, and slew rate
9-11: Switched capacitor circuits
11: Noise analysis
12,13: Sample and hold techniques
14: Analog circuit layout

Text and Other Course Materials:

This course will use lecture notes assembled by the instructor to cover the contents of this course. There will be additional reading materials provided to students to complement the contents covered during lectures.

Course Learning Objectives and Outcomes:

Upon completing this course, students are expected to have the following skills:

1. Be able to understand and analyze sources of variation in CMOS process and their impact on analog circuits (weeks 1 and 2),
2. Be able to apply fundamental design principles for designing practical analog circuits (each week throughout the semester),
3. Be able to choose from different circuit architectures for design tradeoffs based on a given design specification (each week throughout the semester),
4. Be able to design and analyze switched capacitor analog circuits using MOS transistors and capacitors (weeks 9 to 12),
5. Be able to analyze complex analog circuits using Cadence design tools (each week throughout the semester through the labs),
6. Be able to perform design tradeoffs among cost, power consumption, performance, and noise in designing analog circuits (each week throughout the semester), and
7. Understand the general context in which the analog circuits are used in a variety of systems and SOCs (each week throughout the semester).

Instructional Methodology:

The course meets 3 times per week for lectures. The learning style is inquiry-based top-down learning. In addition to basic set of labs, a term project is also required for each student. Discussions will also be held to help students make progress on the term project.

Methods of Evaluation:

This course uses +/- grading with the following scale:

A	≥ 95
A-	≥ 90 and < 95
B+	≥ 86 and < 90
B	≥ 83 and < 86
B-	≥ 80 and < 83
C+	≥ 75 and < 80
C	≥ 70 and < 75
D	≥ 60 and < 70
F	< 60

The final grade will be derived based on the following breakdown:

Homework:	10%
Midterm:	30%
Labs:	30%
Final Design Project:	30%