

Instructor

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Office Hours : Tues./Thurs. 12:00-1:00 p.m.

Netiquette

Carleton guidelines <https://carleton.ca/online/online-learning-resources/netiquette/>.

This class or portions of this class will be recorded by the instructor for educational purposes. These recordings will be shared only with students enrolled in the course. You can access the recordings from the class online lectures section of the course webpage below.

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy. Students requesting the use of assistive technology as an accommodation should contact the [Paul Menton Centre](#). Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University's [Copyright Policy](#), faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as lectures slides, lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials or otherwise circulate these materials without the instructor's written permission. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

During class, all students must enter the class zoom session using their real name and should mute their microphone unless instructed to unmute by the instructor or moderator

During class, student should post questions or comments to the zoom chat which will then be addressed by the instructor or moderator. Keep chat comments focused on course content and keep language respectful. To post questions or comments use the format:

Q: what is the

C: I think the

During class, webcams should be turned off (except for students designated as the front row or when asking a question (optional)) to lower bandwidth use

If students experience difficulties joining a class Zoom session or are dropped from the session a recording of the class Zoom session will be posted on the online class lectures section of the course web page

Office hours and Labs will be carried out using Microsoft teams. Students should use the same netiquette guidelines for office hours and lab sessions.

Course Outline

Introduction

Review of integrated circuit fabrication technology (silicon, implantation, deposition, etc., packaging, testing, layout and design rules), fabrication of passive components (diodes, resistors, capacitors, and inductors) review of active devices MOSFET, etc.

Basic Building Blocks

Review of bias circuits (current sources, voltage sources, DC level shifting, temperature and supply independent biasing), review of gain stages (differential gain stages, active loads, output stages), noise analysis and modeling

Opamps and Comparators

Fundamentals, basic circuit configurations, feedback and compensation, advanced current mirror and opamp configurations, opamps as buffers and comparators, comparator designs

Sample and Hold, D/A and A/D Converters

Sample and hold basics, examples and performance of S/H circuits, data converter fundamentals, nyquist-rate D/A and A/D, oversampling converters

References

- **Carusone, Johns, Martin, Analog Integrated Circuit Design Second Edition, John Wiley&Sons, 2011 (Main Reference)**
- Allen & Holberg, CMOS Analog Circuit Design, Holt, Rinehard and Winston, 1987
- Gray & Meyer, Analysis and Design of Analog Integrated Circuits, second edition John Wiley & Sons, 1984
- Gregorian & Temes, Analog MOS Integrated Circuits for Signal Processing, John Wiley & Sons, 1986
- R. Jacob Baker et. al., CMOS Circuit Design, Layout & Simulation, IEEE Press 1997
- Schaumann, Ghausi & Laker, Design of Analog Filters: Passive, Active RC and Switched Capacitor, Prentice-Hall Inc., 1990
- Sedra & Smith, Microelectronic Circuits, Fourth Edition, Oxford University Press, 1997

Marking Scheme

Assignments	30%
Midterm Exam	20%
Final Exam	50%
Bonus Questions	10%

Time Table

Week	Dates in 2021	Lectures	Additional Comments
1	Sept. 8 start Integrated Circuit Fabrication	Introduction and Lecture1	Lab session on UNIX and introduction to Cadence design tools
2	Sept. 15 finish Integrated Circuit Fabrication	Lecture1	Lab session on Schematic Capture and Simulation Assignment #1
3	Sept. 22 Passive Components	Lecture 2	Lab session on Simulation
4	Sept. 29 Active Components	Lecture 3	Lab session on Layout Assignment #2
5	Oct. 6 Basic Building Block	Lecture 4	Lab session on Extraction and LVS
6	Oct. 13 Noise	Lecture 5	Assignment #3 simulation examples <div style="border: 1px solid black; padding: 2px;">Review old midterm Oct.13</div>
7,9	Oct. 20/Nov. 3 Midterm and start Opamps (part 1)	Lecture 6	Midterm exam Oct. 20 in class
8	Oct. 27		Fall break no classes
10	Nov. 10 Opamps (part 2)	Lecture 7	
11	Nov. 17 Opamps (part 3)	Lecture 8 Analog Design	Assignment #4 Lab session on test benches
12	Nov. 24 Comparators and Sample and Hold Circuits	Lecture 9 Lecture 10	
13	Dec. 1 Data Converter Fundamentals and Nyquist DACs and ADCs	Lecture 11 Lecture 12 Lecture 13	
14	Dec. 8 Review		Review old exam Final Exam Wednesday Dec. 15 7:00p.m. During Class Period

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NOTE: access to cadence from commercial sites is strictly prohibited!!