Instructor

[Ralph Mason](#)   ralphmason@cunet.carleton.ca

Office Hours : Tuesday/Thursday 10:30-11:30 a.m. ME5148

Lecture/Labs: Wednesday 7:05-9:55 p.m. AP332

Academic Accommodations

Carleton guidelines [processes for academic accommodation requests](#)

AI Tools

Use of generative AI tools (such as ChatGPT) in course work is prohibited unless explicitly authorized by the course instructor for specific elements of the course

Special Information for Pandemic Measures

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are [a number of actions you can take](#) to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's [symptom reporting protocols](#).

Masks: Carleton has paused the [COVID-19 Mask Policy](#), but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

Vaccines: Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in [cuScreen](#) as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time.

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	40%
Midterm Exam	20%
Final Exam	40%
Bonus Questions	10%

Time Table

Week	Dates in 2024	Lectures	Additional Comments

1	Sept. 4 start Integrated Circuit Fabrication	Introduction and Lecture1	Lab session on UNIX and introduction to Cadence design tools
2	Sept. 11 finish Integrated Circuit Fabrication	Lecture1	Lab session on Schematic Capture and Simulation Assignment #1
3	Sept. 18 Passive Components	Lecture 2	Lab session on Simulation
4	Sept. 25 Active Components	Lecture 3	Lab session on Layout Assignment #2
5	Oct. 2 Basic Building Block	Lecture 4	Lab session on Extraction and LVS
6	Oct. 9 Noise	Lecture 5	Assignment #3 simulation examples Review old midterm Oct.9
7,9	Oct. 16/Oct. 30 Midterm and start Opamps (part 1)	Lecture 6	Midterm exam Oct. 16 in class
8	Oct. 23		Fall break no classes
10	Nov. 6 Opamps (part 2)	Lecture 7	
11	Nov. 13 Opamps (part 3)	Lecture 8 Analog Design	Assignment #4 Lab session on test benches
12	Nov. 20 Comparators and Sample and Hold Circuits	Lecture 9 Lecture 10	
13	Nov. 27 Data Converter Fundamentals and Nyquist DACs and ADCs	Lecture 11 Lecture 12 Lecture 13	
14	Dec. 4 Review		**Review old exam**

			Final Exam **Wednesday Dec. 11** **7:00p.m.** **During Class Period**

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