EE 491/591: Analog Circuits

(AKA Analog IC design)

Professor: Albert Titus Office: 332 Bonner Hall

Class Meets: Tuesday and Thursday, 11AM-12:20PM in Capen 262

http://www.eng.buffalo.edu/~ahtitus/Classes/

Twitter: twitter.com/analogcircuits

Text: **Analysis and Design of Analog Integrated Circuits** by Gray, Hurst, Lewis and Meyer (5th edition) (required)

UBlearns: The course material will be available on UBlearns. Go to MyUB (www.myub.buffalo.edu) to access UBlearns for this course. All class-related material and information is there.

Grading: (Slight modifications to this may occur)

EE 491 (Undergraduates)		**EE 591 (Graduates)**	
Homework:	30%	Homework:	25%
Exam:	20%	Exam:	30%
Final Group Project:	35%	Final Group Project:	35%
Final Project Presentation:	15%	Final Project Presentation:	10%

Schedule of Topics **(This list is provided as a rough guide, deviations are likely):**

Week	Topic	Chapter
1	MOSFET Device Physics, Layout and Fab	1
2	MOSFET Device Physics, Layout and Fab	2
3	MOSFET Single Stage Amplifiers	3
4	MOSFET Single Stage Amplifiers	3
5	MOSFET Differential Amplifiers	3
6	Current Mirrors and References	4
7	Current Mirrors and References	4
8	Output Stages	5
9	Output Stages	5
10	Amplifiers	6
11	Amplifiers	6
12	Frequency Response	7
13	Frequency Response	7
14	Other Topics	X

Homework:

These will be composed of problems dealing with the design, layout, and simulation of various components that will be discussed in class. There will be four these assignments, with due dates roughly every two weeks posted on UBlearns.

Exams:

There is one exam. It will be held in class on Tuesday, November 22.

Final Project **(group project):**

The final project will be the design, simulation and layout of important circuits. These will be ready for fabrication. Details on the project will be provided beginning in week 5.

Final Project Presentation:

These will be done at the end of the semester. Each group of students will have to do a presentation on their project. Details will be posted later.

Office Hours:

Office hours are: Tuesdays and Thursdays: 1:00-2:00 PM.
My email is ahtitus@buffalo.edu.

Course TA:

The TA is Mark DeMarie (mdemarie@buffalo.edu). Other TA information will be posted on UBLearns.

Software:

CADENCE (More information will be provided on the course website). The CADENCE tools run on the eng Linux machines, so if you are unfamiliar with Linux or UNIX, you should begin **immediately** learning these.

Course Objectives:

By the end of this course, you will be able to:

- Explain quantitatively and qualitatively how a MOSFET operates in a circuit
- Explain DC and small signal operation of MOSFET circuits
- Explain qualitatively MOSFETs' physical structure and how they are fabricated
- Do a mask-level layout of MOSFET circuits and extract those for simulation
- Use SPICE to perform simulations of MOSFET-based circuits
- Design MOSFET-based analog circuits (single and multiple transistor amplifier circuits) according to constraints such as power limits, size limits, speed limits, stability, and/or slew rate limits.

***Other Important Information:* Academic Dishonesty**

Visit http://academicintegrity.buffalo.edu/ for details and FAQs.

"The University at Buffalo takes very seriously its commitment to principles of academic integrity. Our academic community expects the highest {ethical} behavior on the part of our students in the completion and submission of academic work. Students should assume that no assistance or aid is allowable on exams or homework, unless explicitly outlined by the instructor. Even when the instructor allows consultation or collaboration, the student is expected to explicitly footnote the source, extent, and nature of the contribution. Written works must be the complete and original effort of the student, with all ideas and words of others duly attributed according to the appropriate style manual. Furthermore, students should not recycle work in subsequent courses, nor should they facilitate any act of academic dishonesty by another person. If in doubt, the student should err on the side of caution and consult the instructor for additional guidance."

taken from UB's site on Academic Integrity:
http://academicintegrity.buffalo.edu/policies/index.php

Examples of academic dishonesty in this class include, for example:

- In exams or quizzes: Copying, providing aid to another student, obtaining or using aid from another student unless otherwise stated.
- In exams or quizzes: Copying or using any materials (books, magazines, papers, websites, people etc) not explicitly provided by the instructor or allowed by the instructor.
- Plagiarizing material from web sites
- Plagiarizing material from reports or project assignments that have been completed by another student in the course or by students who took the course in previous semesters
- Knowingly sharing solutions with another student (discussing problems is fine)
- If a student is found to have committed academic dishonesty, that student will receive a zero on the assignment, quiz, or exam. If the student is found to commit academic dishonesty a second time, the student will receive an "F" in the class.

(thanks to Dr. V. Paquet)
The above list is not exhaustive. If you have questions about plagiarism, please see examples at:
http://www.princeton.edu/pr/pub/integrity/pages/plagiarism.html
http://www.northwestern.edu/uacc/plagiar.html