University of Portland
Donald P. Shiley School of Engineering

EE451
Advanced Analog Electronics
(3 credit hours)

Course Syllabus
Fall, 2020

Prerequisite: EE352

Lecture Hours: TR 2:30-3:55pm, Online (Zoom)

Course Description: Analysis and design of advanced MOS analog electronic circuits. Topics include advanced MOS semiconductor device models, active loaded amplifiers, operational amplifiers, feedback compensation, and switched-capacitor filters. PSPICE is used as a circuit simulation tool. An introduction to photovoltaics, thermoelectronics, and nanoelectronics is also included.

Course Learning Objectives:

1) Review basic semiconductor device physics including the PN Junction, the BJT, and the MOSFET.
2) Learn analog VLSI circuit design based on MOS technology.
3) Learn design of active-loaded MOS amplifiers including Common Source, Common Gate, Cascode and Differential.
4) Learn design and analysis of a complex CMOS Op Amp.
5) Learn design and analysis of analog VLSI switched-capacitor filters.
6) Introduction to the theory and fundamentals of Photovoltaics.
7) Introduction to the theory and fundamentals of Nanoelectronics.
8) Introduction to the theory and fundamentals of Thermoelectronic Solid-State Power Generation and Refrigeration.
9) Introduction to the theory and fundamentals of Quantum Computers.

Instructor: Dr. Peter Osterberg, oster@up.edu, https://faculty.up.edu/oster, Shiley 225, 943-7416. Office hours online (Zoom). Times posted on my moodle page.

Text: Analog Integrated Circuit Design, Johns and Martin, Wiley, 1997

Assessment Tools:
20% Homework
20% Design Project (paper design)
25% Mid-term Exam
35% Final Exam

Grading Scale:
90% - 100% = A^- - A
80% - 89% = B^- - B^+
70% - 79% = C^- - C^+
60% - 69% = D^- - D^+
Below 60% = F

Class Schedule

Date	Topic	Reading
8/25	Introduction and Semiconductor device physics	1.1, S&S Ch. 3
8/27	Semiconductor device physics	1.1, S&S Ch. 3
9/1	PN junction and BJT device physics	1.2, S&S Ch. 3/6.1
9/3	PN junction and BJT device physics	1.2, S&S Ch. 3/6.1
9/8	MOSFET device physics, PSPICE	1.3, 3.1, 3.2
9/10	MOS current mirror/active load, CS amp	3.1, 3.2
9/15	CS and CG amp	3.1, 3.2, 3.3, 3.4
9/17	Cascode amp	3.7, 3.8
9/22	MOS Diff amp and CD amp	3.7, 3.8
9/24	Fundamentals of Photovoltaics	
9/29	Fundamentals of Photovoltaics	
10/1	Fundamentals of Photovoltaics	
10/6	Mid-term exam review	
10/8	**Mid-term Exam**	
10/13	Fall Break (no class)	
10/15	Fall Break (no class)	
10/20	CMOS op amp	5.1-5.3
10/22	CMOS op amp	5.1-5.3
10/27	CMOS op amp; **Design Project assigned**	5.1-5.3
10/29	CMOS op amp	5.1-5.3
11/3	CMOS op amp stability and compensation	5.1-5.3
10/5	Switched Capacitor Filters (SCF'S)	10.1-10.6
11/10	SCF's, z-transform	10.1-10.6
11/12	SCF's, z-transform, examples	10.1-10.6
11/17	SCF's, z-transform, examples	10.1-10.6
11/19	Fundamentals of Nanoelectronics	
11/24	Fundamentals of Thermoelectronics; **Design Project due**	
11/26	Holiday (no class)	
12/1	Fundamentals of Quantum Computers	
12/3	Final exam review	
12/9	**Final Exam** (1:30pm-3:30pm)	

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Academic integrity is openness and honesty in all scholarly endeavors. The University of Portland is a scholarly community dedicated to the discovery, investigation, and dissemination of truth, and to the development of the whole person. Membership in this community is a privilege, requiring each person to practice academic integrity at its highest level, while expecting and promoting the same in others. Breaches of academic integrity will not be tolerated and will be addressed by the community with all due gravity.

University of Portland's Assessment Disclosure Statement:
Student work products for this course may be used by the University for educational quality assurance purposes.

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The University of Portland endeavors to make its courses and services fully accessible to all students. Students are encouraged to discuss with their instructors what might be most helpful in enabling them to meet the learning goals of the course. Students who experience a disability are also encouraged to use the services of the Office for Accessible Education Services (AES), located in the Shepard Academic Resource Center (503-943-8985). If you have an AES Accommodation Plan, you should make an appointment to meet with your faculty member to discuss how to implement your plan in this class. Requests for alternate location for exams and/or extended exam time should, where possible, be made two weeks in advance of an exam, and must be made at least one week in advance of an exam. Also, you should meet with your faculty member to discuss emergency medical information or how best to ensure your safe evacuation from the building in case of fire or other emergency.

University of Portland's Mental Health Statement:
As a college student, you may sometimes experience problems with your mental health that interfere with academic experiences and negatively impact daily life. If you or someone you know experiences mental health challenges at UP, please contact the University of Portland Health and Counseling Center in Orrico Hall (down the hill from Franz Hall and Mehling Hall) at https://www.up.edu/healthcenter/ or at 503-943-7134. Their services are free and confidential, and if necessary they can provide same day appointments. In addition, after-hours phone counseling is available if you call 503-943-7134 and press 3 outside of business hours. Also know that the University of Portland Public Safety Department (503-943-4444) has personnel trained to respond sensitively to mental health emergencies at all hours. Remember that getting help is a smart and courageous thing to do – for yourself, for those you care about, and for those who care about you.

University of Portland's Non-Violence Statement:
The University of Portland is committed to fostering a community free from all forms of violence in which all members feel safe and respected. Violence of any kind, and in particular acts of power-based personal violence, are inconsistent with our mission. Together, we take a stand against violence. Join us in learning more about campus and community resources, UP's prevention strategy, and reporting options on the Green Dot website, https://www.up.edu/greendot or the Title IX website https://www.up.edu/titleix .

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University of Portland's Learning Commons:
Trained peer tutors and writing assistants in the Learning Commons, located in Buckley Center 163, work with you to facilitate your active learning and mastery of skills and knowledge. For questions about the Learning Commons, please send all correspondence to Jeffrey White, Administrator, at white@up.edu. The Learning Commons is a program of the Shepard Academic Resource Center (SARC).

Math Resource Center: Appointment-based tutoring is available through our online scheduler at www.bit.ly/up_mrc. Walk-in tutoring Sundays through Thursdays evenings. For MTH 141, request appointments at math141@up.edu. The course-specific schedule can be found at www.up.edu/learningcommons, or the reception desk in BC 163.

Writing Assistance: Brainstorming ideas for your paper, create an outline, work on citations, or review a draft with a Writing Assistant. Visit www.up.edu/learningcommons to access our Writing Center schedule.

The Language Studio: Contact the language assistance hotlines to schedule a time to meet throughout the semester at chinesetutor@up.edu, frenchtutor@up.edu, germantutor@up.edu, or spanishtutor@up.edu.

Natural Sciences Center: Send your tutoring requests to biotutor@up.edu, chemtutor@up.edu, or physicstutor@up.edu.

Speech & Presentation Lab: Improve your presentations by requesting an appointment at speech@up.edu.

Group Work Lab: Make an appointment for your group project at groupwork@up.edu.
Nursing Tutoring: Tutoring is available for pathophysiology, BIO205, anatomy and physiology, and other nursing courses on a walk-in or appointment basis. Up-to-date schedule information is at www.up.edu/learningcommons/nursing.

Economics and Business Tutoring: For support in economics, OTM, finance, accounting, and business law courses, send requests for appointments to your discipline's tutor email hotline: econtutor@up.edu, otmtutor@up.edu, financetutor@up.edu, accountingtutor@up.edu, or bizlaw@up.edu.
Shiley Sophomore Fellows: Provides tutoring in several sophomore engineering classes. To make an appointment, send a request to stepUP@up.edu.

Learning Assistance Counselor: Learning assistance counseling is also available in BC 163. The counselor teaches learning strategies and skills that enable students to become more successful in their studies and future professions. The counselor provides strategies to assist students with reading and comprehension, note-taking and study, time management, test-taking, and learning and remembering. Appointments can be made in the on-line scheduler available to all students in Moodle or during posted drop-in hours.

University of Portland's Lab Access Statement:
Shop access is only allowed with appropriate training from shop technicians and with instructor permission. If students require card access to a laboratory, they must receive training from a technician. No food or beverages (including water bottles) are allowed in the computer classrooms, shop, or labs.