Elec_Eng 225-0 -20 FUNDAMENTALS OF ELECTRONICS
Alan V. Sahakian Fall Quarter 2022 *Tentative Schedule v1.3*

Course Description: Fundamental concepts in electronics. Diode, BJT and FET Circuits; design using ideal operational amplifiers; feedback; frequency response; biasing; current sources and mirrors; small-signal analysis; design of operational amplifiers.

Instructor: Alan V. Sahakian, Professor of ECE and (by courtesy) BME, and Associate Dean. Room M394 (faculty office). Office hours (tentative): M, W, F 2:00 -3:00 pm. Additional times whenever office door is open, or as available if closed (knock), or by appointment: (847-491-3641, a-sahakian@northwestern.edu).

Lecture times and room: M,T,W,F 3:00 – 3:50pm, Tech LG62. (Additional times as needed for demonstrations and experiments). Note that some of the TUESDAY lectures will be remotely delivered.

PREREQUISITES: Students must have taken EE221 and EE223 in order to register

Required book: ***Microelectronics Circuit Analysis and Design*** **4th Edition** (Hardcover) by Neamen, Donald, Published by McGraw-Hill Science/Engineering/Math; (September 3, 2009); (ISBN-10: 0073380644 ; ISBN-13: 978-0073380643)

Labs: Students work either alone or in teams of two to build and test circuits using the following equipment, loaned out from the ECE Department: NI/Digilent Analog Discovery II along with the Analog Devices ADALP2000 parts kit. Students will learn to use the Spice circuit simulation package ***LTspice***, which is downloadable from Analog Devices at: https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

TENTATIVE SCHEDULE (*this may change*)

WEEK DATES	TOPICS	READINGS
1 Sept. 20,21,23	Ideal Operational Amplifier – Op amp specifications and applications	Chap. 9
2 Sept. 26,27,28,30	Diode circuits and models - Half and full-wave rectifiers, clamps, logic.	Chaps. 1,2
3 Oct. 3,4,5,7	BJT configurations, models and amplifiers – will discuss dc and ac models for BJT amplifiers, selection of Q-point (active operating point) for dc biasing, load lines for ac analysis, and various amplifiers.	Chaps. 3 and 4
4 Oct. 10,11,12,14	BJT Current sources.	Chap.10
5 Oct. 17,18,19,21	FET configurations, models, and amplifiers – will discuss dc and ac models for FET amplifiers, selection of Q-point (active operating point) for dc biasing, load lines for ac analysis, and various amplifiers.	Chaps.5 and 6
6 Oct. 24,25,26,28	FET Current sources and active loads.	Chap. 10
7 Oct. 31,Nov.1,2,4	**** TOPIC TBD BASED ON PROGRESS IN LECTURE ****	
Nov. 7	**MIDTERM EXAM Part 1 (in LG62)**	
Nov. 8	**MIDTERM EXAM Part 2 (in LG62)**	
8 Nov. 9,11	Bode plot and frequency response	Chap. 7
9 Nov. 14,15,16,18	Power amplifiers and amplifier classes	Chap. 8
10 Nov. 21,22	Differential and multistage amplifiers.	Chap. 11
No lecture Nov. 23 or 25. Nov 24 is Thanksgiving.		
11 Nov. 28,29,30,Dec. 2	NOTES: Power conversion and regulation circuits. Battery operated circuits.	

FINAL EXAM: Monday December 5, 3:00 to 5:00 pm in LG62

GRADING: There will be Midterm and Final Exams, regular homework and dorm experiments with written reports. Tentatively, these four elements will be given equal weight.

COURSE PHILOSOPHY:

This course is intended to bridge from the fundamental circuits and devices knowledge gained in EE221 and EE223 to the practical point of designing and analyzing complex electronic circuits involving multiple semiconductor devices. Modeling and analysis of active circuits including dc and small signal approximations are covered, as is the use of a state-of-the-art circuit simulation tool (Analog Devices/Linear Technology LTspice). Practical breadboarding and testing of circuits is covered using a portable instrumentation (USB) suite and parts kit. Soldering skills for building simple circuits is introduced as time permits. The general goal of the course is to get students to the point where they can design, analyze and build useful and efficient electronic circuits for a wide variety of applications.

Academic Integrity Statement

Students in this course are required to comply with the policies found in the booklet, "Academic Integrity at Northwestern University: A Basic Guide". All papers submitted for credit in this course must be submitted electronically unless otherwise instructed by the professor. Your written work may be tested for plagiarized content. For details regarding academic integrity at Northwestern or to download the guide, visit:
https://www.northwestern.edu/provost/policies/academic-integrity/index.html

Accessibility Statement

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university's established accommodation process (e: accessiblenu@northwestern.edu; p: 847-467-5530). If you already have established accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

COVID-19 Classroom Expectations Statement

Students, faculty, and staff must comply with University expectations regarding appropriate classroom behavior, including those outlined below and in the COVID-19 Code of Conduct. With respect to classroom procedures, this includes:

- Policies regarding masking and social distancing evolve as the public health situation changes. Students are responsible for understanding and complying with current masking, testing, Symptom Tracking, and social distancing requirements.
- In some classes, masking and/or social distancing may be required as a result of an Americans with Disabilities Act (ADA) accommodation for the instructor or a student in the class even when not generally required on campus. In such cases, the instructor will notify the class.
- No food is allowed inside classrooms. Drinks are permitted, but please keep your face covering on and use a straw.
- Faculty may assign seats in some classes to help facilitate contact tracing in the event that a student tests positive for COVID-19. Students must sit in their assigned seats.

If a student fails to comply with the COVID-19 Code of Conduct or other University expectations related to COVID-19, the instructor may ask the student to leave the class. The instructor is asked to report the incident to the Office of Community Standards for additional follow-up.

COVID-19 Testing Compliance Statement

To protect the health of our community, Northwestern University requires unvaccinated students who are in on-campus programs to be tested for COVID-19 twice per week.
Students who fail to comply with current or future COVID-19 testing protocols will be referred to the Office of Community standards to face disciplinary action, including escalation up to restriction from campus and suspension.

Exceptions to Class Modality

Class sessions for this course will occur in person. Individual students will not be granted permission to attend remotely except as the result of an Americans with Disabilities Act (ADA) accommodation as determined by AccessibleNU.

Maintaining the health of the community remains our priority. If you are experiencing any symptoms of COVID do not attend class and update your Symptom Tracker application right away to connect with Northwestern's Case Management Team for guidance on next steps. Also contact the instructor as soon as possible to arrange to complete coursework.

Students who experience a personal emergency should contact the instructor as soon as possible to arrange to complete coursework.

Should public health recommendations prevent in person class from being held on a given day, the instructor or the university will notify students.

Guidance on Class Recordings

This class or portions of this class will be recorded by the instructor for educational purposes. Your instructor will communicate how members of the class can access the recordings. Portions of the course that contain images, questions, or commentary/discussion by students will be edited out of any recordings that are saved beyond the current term.

Prohibition of Recording Classes by Students

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 and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. 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 syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. 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.

Support for Wellness and Mental Health

Northwestern University is committed to supporting the wellness of our students. Student Affairs has multiple resources to support student wellness and mental health. If you are feeling distressed or overwhelmed, please reach out for help. Students can access confidential resources through the Counseling and Psychological Services (CAPS), Religious and Spiritual Life (RSL) and the Center for Awareness, Response and Education (CARE). Additional information on all of the resources mentioned above can be found here:
https://www.northwestern.edu/counseling/
https://www.northwestern.edu/religious-life/
https://www.northwestern.edu/care/