University of Southern California

Ming Hsieh Department of Electrical Engineering

Course Number & Title: EE 348L, Electronic Circuits

Units: 4

Semester: Fall Semester

Schedule: Monday, Wednesday, Friday: 2:00pm-3:50pm

Location: OHE 230

Instructor: Dina El-Damak

Office: PHE 620

Office Hours: TBD

Contact Information: eldamak@usc.edu

Teaching Assistant: Zohreh Azizi (zazizi@usc.edu)

Course Website: https://blackboard.usc.edu

Catalogue Description:
Basic analog and digital circuit design using Bipolar Junction Transistors, Field Effect Transistors, and integrated circuits.

Course Description:
EE 348L is an introductory electronics course that explores the behavior of circuits featuring diodes, MOS Transistors, and other non-linear devices. The course covers the basics of device modeling and the fundamentals of analog circuits analysis, design such as dc-biasing and small-signal analysis of amplifiers as well as applications of integrated circuits.

EE 348L is a pre-requisite for other advanced electronic circuits courses such as EE 448L, EE 479, and EE 536a. Students interested in a career in the integrated circuits design field are encouraged to enroll in these follow-up classes to establish a strong background in mixed-signal integrated circuits design and communication circuits. Engineers specializing in this area continue to be in high demand.

Grading:
EE 348L grade is based on the following components:
Midterm Exam: 35% (October 16th)
Homework (5): 20%
Labs & Projects: 10%
Final Exam: 35% (Friday, December 13th, 2-4 pm at OHE 230)

References:

- B. Razavi, "Fundamentals of Microelectronics," 2nd Edition. Wiley Higher Ed. **(Main text book)**
- Edward W. Maby, "Solid-State Electronic Circuits" (2012)
  Available Online: http://ee-classes.usc.edu/ee348/Maby-SSEC.pdf
- R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Second edition, Springer US, 2001.

Course Administration:

- EE 348L has lecture-lab sessions on MWF 2:00pm – 3:50pm. The co-requisite is EE 338. The last day to drop the class without a W grade is October,11th. The last day to drop the class with a W grade is November,15th. Incomplete grades (IN) are rarely assigned. This grade may be justified, but only in exceptional cases such as student illness or a personally tragic event that occurs after the twelfth week of the semester.

- **Make-up exams are not available.** If you are absent during an examination, you will receive a grade of zero unless you have a valid reason for your absence, **and you have discussed it with the instructor before the exam.** In the event of an excuse from a midterm, a weighted final exam score will replace the missing score. If you cheat during the exam, you will receive a grade of F in the course, and you will be reported to the Office of Student Judicial Affairs and Community Standards for disciplinary action.

- Homework is crucial in EE 348L, since it provides much-needed practice in analytical techniques, it is a good measure of whether you understand fundamental concepts, and it is a prerequisite for good performance on course exams. If your weighted course average places you on the borderline between two letter grades, a poor homework average will significantly increase the probability of the lower grade.

- **Try not to miss class!** Students who are regularly absent typically receive poor grades. The instructor has no reservations about compiling homework assignments and exams that are predicated, in part, on material discussed in class but not in assigned readings. Historically, the average grade for EE 348L is B- following the application of a "curve." Notwithstanding, the instructor is prepared to accept a higher average if the class does exceptionally well -- for example, a total class average score of 99/100 is an A.

- You are encouraged to use circuit design tools such as LTspice to check homework and compare your analytical solution to the simulation results, but please notice that you will not have access to it during the exams.

Tentative Weekly Schedule:

Week	Date	Subject	Reading	Homework
1	Mon 08/26/2019	**Lecture 1: Class Introduction, Review.** - Introduction to Microelectronics: Basic Concepts Analog and Digital Signals, Basic Circuit Theorems	**Handout #1** 1.3, 8.1, 8.2.1, 8.2.2	
	Wed 08/28/2019	**Lecture 2:** Basic Physics of Semiconductors Review cont. - Semiconductor Materials and Their Properties - PN Junction	**Handout #2** Optional 2	
	Fri 08/30/2019	Discussion Session: Review and Lab Introduction		
2	Mon 09/02/2019	Labor Day, university holiday		
	Wed 09/04/2019	**Lecture 3:** PN Junction cont., and Diode Models	**Handout #3** 3.1, 3.2	
	Fri 09/06/2019	Discussion Session: Homework1		HW 1 Out
3	Mon 09/09/2019	**Lecture 4:** Diode Models cont.		
	Wed 09/11/2019	**Lecture 5:** Diode Circuits - Half-Wave and Full-Wave Rectifier - Limiting Circuits	**Handout #4** 3.5.1, 3.5.3	
	Fri 09/13/2019	Discussion Session: Homework2 Overview, LTSPICE		HW 1 Due HW 2 Out
4	Mon 09/16/2019	**Lecture 6:** MOSFET I - Structure of MOSFET - Operation of MOSFET	**Handout #5** 6	
	Wed 09/18/2019	**Lecture 7:** MOSFET II - MOS Device Models - PMOS Transistor - CMOS Technology		
	Fri 09/20/2019	Lab and PCB Design Tutorial		HW 2 Due
5	Mon 09/23/2019	**Lecture 8:** Amplifiers: Biasing and Small-Signal models I - Common Source Stage	**Handout #6** 17	
	Wed 09/25/2019	**Lecture 9:** Amplifiers: Biasing and Small-Signal models II - Common-Gate Stage, Source Follower		
	Fri 09/27/2019	Discussion Session: Homework3 Overview.		HW 3 Out Lab Report Due
6	Mon 09/30/2019	**Lecture 10:** CMOS Amplifiers Examples		
	Wed 10/02/2019	**Lecture 11:** DC-DC Converter I - Principles of Steady-State Converter Analysis - Buck (Step-down) Converter	**Handout #7**	
	Fri 10/04/2019	Lab Project		HW 3 Due
7	Mon 10/07/2019	Midterm Review		
	Wed 10/09/2019	Lab Project		
	Fri 10/11/2019	Lab Project		
8	Mon 10/14/2019	**Lecture 12:** DC-DC Converter II - Boost (Step-up) Converter		
	Wed 10/16/2019	Mid-Term Exam (2:00pm – 3:50pm)		
	Fri 10/18/2019	Fall recess		
9	Mon 10/21/2019	**Lecture 13:** BJT I - Structure of Bipolar Transistor - Operation of Bipolar Transistor	**Handout #8** 4.1, 4.2, 4.3,	
	Wed 10/23/2019	**Lecture 14:** BJT II - Bipolar Transistor Model and Characteristics - The PNP Transistor	4.4, 4.6, 4.7	
	Fri 10/25/2019	Discussion Session: Lab Project Design Review		

10	Mon 10/28/2019	**Lecture 15:** Cascode stages	**Handout #9** 9.1	
	Wed 10/30/2019	**Lecture 16:** Current Mirrors	**Handout #10** 9.2.3	
	Fri 11/01/2019	Discussion Session: Design Final Review and Submission		PCB Design Due
11	Mon 11/04/2019	**Lecture 17:** Differential Amplifiers I - Differential Signals - Differential Pair	**Handout #11** 10.1, 10.3	
	Wed 11/06/2019	**Lecture 18:** Differential Amplifiers II - Large-Signal Analysis - Small-Signal Analysis		
	Fri 11/08/2019	Discussion Session: Homework4 Overview		HW 4 Out
12	Mon 11/11/2019	**Lecture 19:** Frequency Response I - Fundamental Concepts - High-Frequency Model of MOSFET	**Handout #12** 11.1, 11.2.2, 11.3, 11.4.1	
	Wed 11/13/2019	**Lecture 20:** Frequency Response II - Frequency Response of CS Stage		
	Fri 11/15/2019	Project Soldering and Testing		HW 4 Due
13	Mon 11/18/2019	**Lecture 21:** Feedback I - Properties of Negative Feedback - Types of Amplifiers	**Handout #13** 12.1, 12.2, 12.3,	
	Wed 11/20/2019	**Lecture 22:** Feedback II - Sense and Return - Polarity of Feedback - Feedback Topologies	12.4, 12.5, 12.6	
	Fri 11/22/2019	Discussion Session: Homework 5 Overview		HW 5 Out
14	Mon 11/25/2019	Project Soldering and Testing		
	Wed 11/27/2019	Thanksgiving Holiday		
	Fri 11/29/2019	Thanksgiving Holiday		
1 5	Mon 12/02/2019	**Lecture 23:** Digital Circuits	**Handout #14**	HW 5 Due
	Wed 12/04/2019	Final Review		
	Fri 12/06/2019	Project Soldering and Testing		

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu
Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support
Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
studentaffairs.usc.edu/ssa
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.