UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering and Computer Sciences

EE 105: Microelectronic Devices and Circuits

Instructor: Professor Ming C. Wu, mingwu@berkeley.edu Office: 511 SDH
Office Hours: Tuesday 2-3 pm; Thursday 11-12 pm @ 511 SDH

GSIs: Kevin Han, kyh@berkeley.edu (15 hour GSI)
Office Hours: tbd
Jean-Etienne Tremblay, jetremblay@berkeley.edu (20 hour GSI)
Office Hours: tbd

Lectures: Tuesday and Thursday 9:30A-10:59A at 521 Cory

Discussion Sections:

DIS 201	F 11:00A-11:59A	243 Dwinelle
DIS 202	W 2:00P-2:59P	126 Wheeler

Lab Sections:

LAB 101	M 8:00A-10:59A	125 Cory
LAB 102	M 2:00P-4:59P	125 Cory
LAB 103	M 5:00P-7:59P	125 Cory

Objective:
Introduce analog/digital mixed signal design, basic device physics including PN-junction diodes and MOS transistors, and single/multi-stage amplifiers.

Prerequisite:
KVL and KCL, node-voltage analysis, Thevenin and Norton equivalent circuits, design and analysis of circuits with operational amplifiers, impedance, time domain analysis, frequency response (Bode plots), analog vs. digital signals, laboratory techniques (breadboarding and operation of supplies, digital multimeter, oscilloscope, function generator). These materials are covered in EE16A/B.

Relation to Other Courses:
EE105 is a prerequisite for EE140 (Linear Integrated Circuits) and EE142 (Integrated Circuits for Communications). It is also helpful (but not required) for EE130 (Integrated Circuit Devices), EE147 (MEMS).

Textbook: *Sedra and Smith, Microelectronic Circuits,* Oxford University Press, 2014 (7^{th} Ed)

Website:
Most materials, including lectures, HWs, Labs, will be posted in http://inst.eecs.berkeley.edu/~ee105/sp19/
Solutions, exams, and grades will be posted in https://bcourses.berkeley.edu/

Lab Policy:
Lab is an integral part of the course. You must complete all Labs to pass the course. Students will work in groups of two in the lab session. Students should attend the Lab section they are enrolled in. All of the lab assignments – along with helpful tutorials -- are in bCourses. It is very important that you read

all lab materials in advance, and complete the Pre-Lab assignment. The Pre-Lab is due at the beginning of the corresponding lab session. Post-lab assignments (Lab Reports) are due at the beginning of the following lab session. Although students will work in pairs during the lab sessions, each student must individually turn in his/her own pre-lab and post-lab assignments.

Homework:

- Weekly homeworks will be assigned on Fridays at course website. They are due the following Friday at 11 pm.
- Submit your homework through bCourses, which will be time-stamped.
- Late homework will not be accepted.
- Lowest score homework will be dropped from grade calculation
- You may discuss homework problems with other students in the class, the GSIs, or the instructor. However, the work you submit for grading must be your own.

Midterms:

Two midterms (80 minutes each) will be given in class. These are intended to gauge the student's understanding of the basic concepts covered in the course. Some numerical calculations might be required, so remember to bring your calculator. All exams will be closed book (with 2 pages of cheat sheets allowed).

Final Exam:

The final exam will be closed book, with 6 pages of notes allowed. Students will need to bring a calculator. No early final exam will be offered.

Grading: Your grade will be computed from a weighted average of

Homework	15%	Lowest score dropped from grade calculation
Lab	30%	You must complete all labs to pass the course!
Midterm-1	15%	
Midterm-2	15%	
Final Exam	25%	Wed, May 15, 11:30A - 2:30P

Academic Dishonesty:

See Department policy at
https://eecs.berkeley.edu/resources/grads/policies/academic/academic-dishonesty
Cheating will result in automatic Fail. Copying homeworks or lab reports is considered cheating.

Course Accommodations:

Students may request accommodation of religious creed, disabilities, and other special circumstances. Please make an appointment with Prof. Wu to discuss your request before the end of second week so that he can plan accordingly in advance.

Classroom Etiquette:

- Arrive in class on time!
- Turn off cell phones.
- No distracting conversations -- relevant questions are encouraged

Class and Lab Schedule:

Date	**Topic**	**Reading**	**Lab** (on Mondays)
Module 1: Linear system and Op-Amplifiers			
1/22	Introduction		
1/24	Linear time-invariant system, frequency response, Bode plot	Chap. 1, (Skip Sec. 1.5)	
1/29	Practical operational amplifiers	Sec. 2.1-2.3, 2.7	**Lab 0**: Introduction to SPICE
1/31	Non-ideal Op Amps (cont'd)	Sec. 2.6, 2.8	
Module 2: Semiconductors, p-n junctions, and diode circuits			
2/5	Introduction to semiconductors	Sec. 3.1-3.3	**Lab 1**: Review of Passive Networks
2/7	Intro to semiconductors (cont'd)		
2/12	p-n junctions	Sec. 3.4-3.6	**Lab 2**: Characterization of the 741 Op Amp
2/14	Semiconductor fabrication		
2/19	Diode circuits	Sec. 4.1-4.4	
2/21	Diode circuits (cont'd)	Sec. 4.5-4.7	
Module 3: MOS capacitors, MOSFETs			
2/26	MOS capacitors	Sec. 5.1	**Lab 3**: Configurable Amplifiers Using Small-Signal MOS Resistors
2/28	review		
3/5	**Midterm-1**		
3/7	MOSFET	Sec. 5.1-5.3	
3/12	MOSFET		**Lab 4**: Biasing of MOS Transistors
3/14	MOSFET large signal model	Sec. 7.1	
3/19	MOSFET small signal models	Sec. 7.2.1	**Lab 5:** Common Source Amplifier Design Project
3/21	MOSFET small signal models		
3/26	**Spring Break**		Lab 5 cont'd
3/28	**Spring Break**		
Module 4: MOSFET Amplifiers, bias circuits			
4/2	Single-stage amplifiers	Sec. 7.3	
4/4	Single-stage amplifiers (cont'd)		
4/9	**Midterm-2**		
4/11	Frequency response	Sec. 10.1-10.3	
4/16	Frequency response	Sec. 10-4-10.6	**Lab 6:** Multi-Stage Amplifier Design Project
4/18	Current source	Sec. 8.1, 8.2	
4/23	Multi-stage amplifiers	Sec. 8.7	Lab 6 cont'd
4/25	Multi-stage amplifiers (cont'd)		
4/29	Differential amplifiers	Sec. 9.1, 9.3.1	
5/2	Path to OpAmps	Sec. 13.1.1	
5/6-5/10	**RRR Week**		
5/15	**Final Exam**		