Course Syllabus

UNIVERSITY OF CALIFORNIA

Department of Electrical Engineering and Computer Sciences

EE 105: MICROELECTRONIC DEVICES AND CIRCUITS

Spring 2015 Prof. David J. Allstot

Professor: David J. Allstot (allstot@eecs.berkeley.edu, Office: 564 Cory)

GSIs: Pengpeng Lu (pengpenglu@berkeley.edu)

Pramod Murali (pramodm@eecs.berkeley.edu)

Objective:

To provide a basic understanding of semiconductor devices (p-n junction diodes, bipolar and field effect transistors) and the design of analog integrated circuits using these devices.

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, DVM, oscilloscope and function generator). This material is covered in EE 40.

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 EE141 (Intro. to Digital Integrated Circuits).

Textbook: *Microelectronic Circuit Design*, 4th Edition, by Richard C. Jaeger and Travis N. Blalock, McGraw-Hill, 2011.

Lectures (155 Donner Lab)**:** Tuesday, Thursday 2:00 to 3:30 pm

Discussion Sections (beginning on Monday 1/26):

Section 101 (247 Cory): Mondays 4-5 pm Pramod Murali

Section 102 (241 Cory): Wednesdays 11-12 am Pramod Murali

* Please attend the section in which you are enrolled.

Office Hours:

David J. Allstot: (564 Cory): Tuesday, Thursday 4:00 to 6:00 pm

Pengpeng Lu (504 Cory): Wednesday 2:00 to 3:00 pm

Pramod Murali (504 Cory): Thursday 10-11 am

Laboratory Sections (beginning on Monday 2/2):

Section 010 (125 Cory): Monday 10 am - 1 pm; Pengpeng Lu

Section 011 (125 Cory): Tuesday 9:00 am - 12:00 am; Pengpeng Lu

Section 012 (125 Cory): Wednesday 3 -6 pm; Pengpeng Lu

Students should attend the Lab section in which they are enrolled. All of the lab assignments – along with helpful tutorials -- are posted online under Labs. Each pre-lab assignment is due at the beginning of the corresponding lab session. Post-lab assignments are due at the beginning of the following lab session. Although students will be allowed to work in pairs during the lab sessions, each student must individually turn in his/her own pre-lab and post-lab assignments.

* You must turn in the Lab Report on time. Late reports will be discounted by 50%.

Homework:

Weekly assignments will be posted online on Fridays. They are due the following Friday at 5 pm. Turn them in at the EE105 Drop box in Cory Hall (near TI Lab). Late homework will not be accepted.

You are encouraged to discuss homework problems with other students in the class, the GSIs, and the instructor. However, the work that you submit for grading must be your own.

Midterms:

Two midterms (50 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 (*i.e.*, bring your calculator). All exams will be closed book (with 2 pages of notes).

Final Exam:

The final exam will be closed book, with 4 pages of notes allowed. Students will need to bring a calculator. The Final Exam for Group #2 will be given on **Monday 5/11 from 11:30 am 2:30 pm**. No early final exam will be offered.

Grading:

Your grade will be computed from a weighted average of

Homework: 10% (Lowest score will be dropped from grade calculation)

Lab: 20% (You must complete all labs to pass the course!)

Midterms: 30% (15% each)

Final Exam: 40%

Academic Dishonesty: See Department policy at http://www.eecs.berkeley.edu/Policies/acad.dis.shtml

Course Accommodations:

Students may request accommodation of religious creed, disabilities, and other special circumstances. Please make an appointment with Prof. Allstot to discuss your request before the end of second week (Jan. 30), so that he can plan accordingly in advance.

Date	Lectures	Reading (J&B)	HW	Lab
Tu - 1/20	**Introduction** and **Overview**	1.1 – 1.7		
1/22	**Review:** Amplifier model, Ideal opamps	Chap. 10		No Labs
Tu - 1/27	**Review:** Frequency response, Bode plot	Chap. 10	1	Review Recitations, Lab Intro: Teaming SPICE Instruments
1/29	**Non-ideal Opamps**: feedback, Circuits	11.1 – 11.6		
Tu - 2/3	**Non-ideal Opamps:** finite gain, bandwidth	11.1 – 11.6	2	**Lab 1**
2/5	**Non-ideal Opamps:** offset, bias current	11.11 – 11.13		
Tu - 2/10	**PN Junction Diodes,** junction capacitance, diode model	3.1 – 3.4, 3.7, 3.9	3	**Lab 2**
2/12	**Bipolar junction transistor (BJT):** physics, regions of operation, transit time	5.1 – 5.6		
Tu - 2/17	**MOSFET:** physics of MOSFET capacitor, MOSFET, regions of operation	4.1 – 4.7	4	**Lab 3**
2/19	**MOSFET:** DC analysis, model			
Tu - 2/24	**BJT:** DC analysis, small-signal models	5.7 – 5.11, 13.1 – 13.5		**No Lab**
2/26	**Midterm 1**			

Date	Lectures	Reading (J&B)	HW	Lab
Tu - 3/3	BJT: DC Analysis, Bias Circuits	5.1 – 5.11		
3/5	BJT Small-Signal Models	13.1 – 13.5	5	Lab 4
Tu - 3/10	MOSFET Small-Signal Models	13.6 – 13.12		
3/12	Frequency Response	17.1 – 17.3		Lab 4 (cont)
Tu - 3/17	Short Circuit Time Constant (SCTC) Method	17.4 – 17.5		
3/19	High Frequency Transistor Model	17.4 – 17.5	6	
3/23 – 3/27	**Spring Recess**			
Tu - 3/31	Miller Effect and Open Circuit Time Constant Method	17.6		Lab 5
4/2	Single Transistor Amplifier Configurations	14.1 – 14.5	7	
Tu - 4/7	Midterm Review			
4/9	**Midterm 2**		8 (No submission)	
Tu - 4/14	Current Mirrors	16.1 – 16.4		Lab 6
4/16	Multi-Stage Amplifiers	14.9, 17.10	9	
Tu - 4/21	Frequency Response of CE, CB, and CC Multi-Stage Amps	17.6 – 17.9 17.10.2		No Labs
4/23	Operational Amplifiers		10	
Tu - 4/28	Digital Circuits, CMOS Inverters, NOR, NAND	7.1 – 7.6		Lab 6 (cont)
4/30	Final Exam Review		11	
Mon 5/11	**Final Exam – Group #2** **11:30 – 2:30**			