

EE221: PRINCIPLES OF SEMICONDUCTOR DEVICES I

David W. Parent
Assistant Professor
Office Hours:
M 11:45-12:45
MW 2-3
F after EE198A lets out ~ 130pm
EE Department SJSU
PH: 408.924.3963
EM: dparent@email.sjsu.edu
HP: <http://www.engr.sjsu.edu/dparent>
Email is the best way to contact me.

Course Description:

Study of semiconductors in equilibrium and nonequilibrium conditions; principles of semiconductor device fabrication, p-n junctions; and junction transistors; device modeling for circuit analysis. Synopsys TCAD tools will be used extensively.

Course Aims:

1. Prepare graduate students for a career in circuit (analog or full custom digital) design
2. Prepare graduate students for further study in device physics
3. Prepare graduate students to be able to make technology decisions based on science.

Course Objectives (Outcomes):

- Students should be able to intuitively explain semiconductor device phenomenon.
- Students should be able to use analytical and TCAD models for device fabrication design.
- Students should be able to develop a Spice Level 3 MOSFET model from measured data.
- Students should be able to understand the device issues relating to analog and digital CMOS circuit design.
- Students should be able to explain MOS sub threshold behavior.

Outcome Assessment (Grading):

- Homework (10%): (-20% per day late)
- Exam 1 (17%):
- Exam 2 (17%):

- Project (20%):(-20% per day late)
- Final Exam (36%):

Class Schedule:

#	Date	Topic	Reading	HW Due
1	8/25/2008	Getting Started		
2	8/27/2008	Introduction/ How to do A Lit Review	1.1, 1.2	
3	9/1/2008	No Class		
4	9/3/2008	Energy Bands and Carrier Concentration in TE	2.1-2.3	HW1
5	9/8/2008	Energy Bands and Carrier Concentration in TE	2.4-2.7	
6	9/10/2008	Carrier Transport Phenomena	3.1-3.4	
7	9/15/2008	Carrier Transport Phenomena	3.5-3.7	HW2
8	9/17/2008	PN Junction	4.1-4.2	
9	9/22/2008	PN Junction	4.3-4.4	
10	9/24/2008	PN Junction	4.5-4.6	
11	9/29/2008	PN Junction	4.7-4.8	HW3
12	10/1/2008	Exam 1		
13	10/6/2008	Literature Review		
14	10/8/2008	MOSFET	6.1	
15	10/13/2008	MOSFET	6.2	
16	10/15/2008	MOSFET	6.3	HW4
17	10/20/2008	MOSFET	6.4	
18	10/22/2008	MOSFET	6.5	
19	10/27/2008	MOSFET	6.6-6.7	
20	10/29/2008	Review		HW5
21	11/3/2008	Exam 2		
22	11/5/2008	MOSFET	EKV	
23	11/10/2008	MOSFET	Sub threshold	
24	11/12/2008	MOSFET	Review	
25	11/17/2008	BJT	5.1	
26	11/19/2008	BJT	5.2	
27	11/24/2008	BJT	5.3	HW7
28	11/26/2008	BJT	5.4	
29	12/1/2008	No Class		
30	12/3/2008	No Class		
31	12/8/2008	BJT	Review	HW8
32	12/10/2008	Over All Review		
33	12/16/2008	Final Exam 12:15-1430		

Textbooks:

Required: *Semiconductor Devices*, by S.M. Sze ISBN 0-471-33372-7, John Wiley & Sons, Inc, New York (2002)

Additional Resources:

- Solid State Electronics Devices, Ben G. Streetman, ISBN 0-13-025538-6, Prentice Hall, New Jersey (2000).
- VLSI Fabrication Principles, Sorab K. Ghandhi, ISBN 0471-58005-8, John Wiley and Sons, New York (1994).
- Silicon Processing for the VLSI Era, S. Wolf, and R.N. Tauber, ISBN0-9616721-6-1, Lattice Press, Sunset Beach (2000).
- R. C. Jaeger, Introduction to Microelectronic Fabrication, ISBN 0-201-44494-1
- Sze, VLSI Technology, McGraw-Hill, 1998

Lab Activities:

Lab activities will consist of tutorials, HW problems and a final project in the area of TCAD process and device simulations (Synopsys Sentaurus). Students can pick from modeling MOSFETS, BJTS, Photonic Devices. Opportunities will exist for MOS capacitor fabrication and device testing with hp4145.

Office hours: After Class

Grading Percentage Breakdown

94% and above	A
93% - 90%	A-
89% - 87%	B+
86% - 84%	B
83% - 80%	B-
79% - 77%	C+
76% - 74%	C
73% - 70%	C-
69% - 67%	D+
66% - 64%	D
63% - 60%	D-
below 60%	F

Extra credit options:

There will be opportunities to earn extra credit. For example one might attend the ISSC conference or various on campus activities or have the best project for the semester. There will be no extra credit given after the final exam.

Eating:

Eating and drinking (except water) are prohibited in the Boccardo Business Center. Students with food will be asked to leave the building. Students who disrupt the course by eating and do not leave the building will be referred to the Judicial Affairs Officer of the University.

Cell Phones:

Students will turn their cell phones off or put them on vibrate mode while in class. They will not answer their phones in class. Students whose phones disrupt the course and do not stop when requested by the instructor will be referred to the Judicial Affairs Officer of the University.

Computer Use:

In the classroom, faculty allow students to use computers only for class-related activities. These include activities such as taking notes on the lecture underway, following the lecture on Web-based PowerPoint slides that the instructor has posted, and finding Web sites to which the instructor directs students at the time of the lecture. Students who use their computers for other activities or who abuse the equipment in any way, at a minimum, will be asked to leave the class and will lose participation points for the day, and, at a maximum, will be referred to the Judicial Affairs Officer of the University for disrupting the course. (Such referral can lead to suspension from the University.) Students are urged to report to their instructors computer use that they regard as inappropriate (i.e., used for activities that are not class related).

Academic Honesty:

Faculty will make every reasonable effort to foster honest academic conduct in their courses. They will secure examinations and their answers so that students cannot have prior access to them and proctor examinations to prevent students from copying or exchanging information. They will be on the alert for plagiarism. Faculty will provide additional information, ideally on the green sheet, about other unacceptable procedures in class work and examinations. Students who are caught cheating will be reported to the Judicial Affairs Officer of the University, as prescribed by [Academic Senate Policy S04-12](#). "You are responsible for understanding the policies and procedures about add/drops, academic renewal, withdrawal, etc. found at <http://www2.sjsu.edu/senate/S04-12.pdf>

- Expectations about classroom behavior; see [Academic Senate Policy S90-5](#) on Student Rights and Responsibilities.
- As appropriate to your particular class, a definition of plagiarism, such as that found on Judicial Affairs website at <http://www2.sjsu.edu/senate/plagiarismpolicies.htm>
- "If you would like to include in your paper any material you have submitted, or plan to submit, for another class, please note that SJSU's Academic Integrity policy