

Semiconductor Device Processing

Electrical and Computer Engineering Department / Materials Department
University of California, Santa Barbara

In this class, we will cover the fundamentals of semiconductor processing. The class meets two days per week and is supplemented by lab projects, which are performed in the teaching cleanroom on the 4th floor of Engineering I. In the classroom, we will study a number of techniques used in the processing of semiconductor devices. In the lab, you will get to experiment with the techniques discussed in class. You will also fabricate and test an NMOS transistor.

Topics to be covered

- Thermal Oxidation
- Junction Formation
 - Diffusion
 - Ion implantation
- Optical Lithography
- Etching
 - Wet Etching
 - Reactive Ion Etching
- Thin Film Deposition
 - Evaporation
 - Sputtering
 - Chemical Vapor Deposition
- Ohmic Contact Formation
- NMOS Process and Characterization

Instructor: Ilan Ben-Yaacov, ESB Room 2213, ext. 5295, ilan@engineering.ucsb.edu

Time: Tuesday and Thursday 12:00-1:50 p.m.

Place: PHELPS 1437

Required Text: *Silicon Processing for the VLSI Era: Volume 1 - Process Technology* by S. Wolf and R. N. Tauber, published by Lattice Press, 2000.

Other texts you may find useful:

VLSI Fabrication Principles by S. K. Ghandi, published by Wiley Interscience, 1994.

The Science and Engineering of Microelectronic Fabrication by Stephen A. Campbell, published by Oxford, 2001.

Handouts and class notes will complement the text. All handouts, including this syllabus, can be downloaded from the class web page: http://my.ece.ucsb.edu/ECE220A_MAT215A_F2004

Prerequisite: Basic understanding of semiconductor materials or consent of the instructor.

Course Format: There will be homework assignments, a midterm, laboratory work, and a final lab project. Laboratory work will consist of experimenting with various processes such as lithography, thermal oxidation, and wet etching, and determining process tolerances. For the final project, you will use the skills you have developed in the lab to fabricate and characterize a MOS transistor. Homework, midterm, lab, and final lab project will each contribute 25%, 25%, 10% and 40% to the final grade.

Office Hours: Office hours are Tuesdays and Thursdays 2:30-3:30 p.m. or by appointment.

Laboratory Hours: There are no scheduled hours for the lab work. The teaching cleanroom will be available at most times with key card access, if two or more students are working together. For safety reasons, you will not be permitted to work alone. There will be equipment demonstration sessions, which are required.

Lab Safety: It is essential that safety procedures be followed at all times. You will be working with acids (including HF), bases, and organic solvents that can be hazardous if not handled properly. You are required to attend a safety orientation session before you will be permitted to enter the lab. There are sessions provided by the university, or a series of tapes provided by the ECE department and Martin Vandebroek.

Lab Supervisor: Martin Vandebroek, Room 4110, Eng I, ext. 4142, mav@ece.ucsb.edu

Teaching Assistants: The TA's are Danny Feezell (feezell@engineering.ucsb.edu) and Chris Sarantos (csarantos@engineering.ucsb.edu), lab hours TBA.

Class Web Page: http://my.ece.ucsb.edu/ECE220A_MAT215A_F2004