

## Semiconductor Device Processing

Electrical and Computer Engineering 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 4<sup>th</sup> floor of Harold Frank Hall. 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

- Optical Lithography
- Thermal Oxidation
- Junction Formation
  - Diffusion
  - Ion Implantation
- 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](mailto:ilan@engineering.ucsb.edu)

Time: Tuesday and Thursday 9:30-10:45 a.m.

Place: GIRV 2123

Required Text: *Fundamentals of Semiconductor Fabrication* by G. S. May and S. M. Sze, published by John Wiley and Sons, 2004, ISBN 0-471-45238-6.

### Other texts you may find useful:

*Fabrication Engineering at the Micro- and Nanoscale (3<sup>rd</sup> edition)*, by Stephen A. Campbell, published by Oxford, 2008.

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

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/ECE124B>

Prerequisite: ECE 132 with a grade of C- or better, or equivalent, or consent of 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 10%, 35%, 15%, and 40% to the final grade.

Office Hours: Instructor office hours are Tuesdays and Thursdays 10:45 - 11:45am in ESB room 2213.

Laboratory Hours: There are no scheduled hours for the lab work. The instructional cleanroom will be available M-F 8am-5pm 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 Bob Hill.

Lab Supervisor: Bob Hill, Room 1141, Engineering II, ext. 4142, [bob@ece.ucsb.edu](mailto:bob@ece.ucsb.edu)

Teaching Assistants: Samuel Beach ([beach@umail.ucsb.edu](mailto:beach@umail.ucsb.edu)), office/lab hours TBA

Class Web Page: <http://my.ece.ucsb.edu/ECE124B>