

# ECE 330 Introduction to Semiconductor Devices

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**Course level:** Undergraduate students

**Prerequisite:** ECE 225 and PHY 253

**Lectures:** TR 9:30 am - 10:45 am, SERC, room 1014

**Office hours:** TR 2:00 pm - 3:00 pm, or per appointment

## Course description

This course is devoted to the study of semiconductor physics and its application to semiconductor devices. Topics to be covered include fundamentals of semiconductor physics, junction and Schottky diodes, optoelectronic diodes, BJTs, MOSFETs, and basics of semiconductor device fabrication. The goal of this course is to develop a basic understanding of the electronic properties of semiconductors and the physical operation of semiconductor devices. This course requires students to **think** and **understand concepts**. The ability to perform mathematical calculations, or reproduce a problem solving procedure alone will not allow students to succeed. The concepts in this course are abstract, demanding more on critical thinking rather than on repetition and mechanical calculations.

**Topics to be covered** (tentative, subject to change):

### Part I: Semiconductor Physics

1. Crystal structure and energy band
2. Effective mass, density of states
3. Fermi-Dirac statistics
4. Carrier distribution and doping
5. Drift and diffusion, continuity equation (**Midterm exam 1**)

## Part II: Semiconductor Devices

6. Basics of device fabrication
7. PN junction
8. Optoelectronics diodes
9. Schottky diode
10. BJT (**Midterm exam 2**)
11. MOS capacitor
12. MOSFET
13. Applications of MOS capacitor and MOSFET (**Final exam**)

### Required textbook

Pierret, Robert F., *Semiconductor Device Fundamentals*, Addison-Wesley, c1996.

**Reference books** (on reserve in Science and Engineering Library):

Ben Streetman and Sanjay Banerjee, *Solid State Electronic Devices* (6th Edition), Prentice Hall, 2006

### Homework and exam policy

Discussion in small groups is encouraged for homework. However, each student should work through problems individually. No late homework will be accepted. Exams will be completed individually during class time, and will be closed book. If an examination is missed due to a University approved activity or documented emergency/illness, the grade of comprehensive final exam will be used in place of the missing exam score. Missed examinations due to unexcused absences receive the grade of zero. No makeup exams will be provided under any circumstances.

### Grading

Homework, weekly .....	20%
Midterm exam 1 .....	25%
Midterm exam 2 .....	25%
Final Exam .....	30%