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 pm, SERC 1056

Office hours: MW 1:00 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

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

Homework and exam policy

Discussion in small groups is encouraged for homework. However, each student should work through problems individually. Late homework will receive a maximum score of 50%, up to two days late. Homework later than two days will receive the grade of zero. Exams will be completed individually during class time, and will be closed book. Missed examinations due to unexcused absences receive the grade of zero. No makeup exams will be provided except under dire circumstances.

Grading

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