ECE 430/530 Solid-State Devices

Instructor: Dr. Dawen Li, Associate Professor
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Course level: graduate students and senior undergraduate students

Prerequisite: PHY 253 and ECE 330

Lectures: TR 12:30 pm - 1:45 pm, SERC, room 2036

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

Course description

ECE 430/530 (Solid-State Devices) is devoted to the study of solid-state devices based on the principles of solid-state physics. Devices for study include PN junction, Schottky diodes, BJTs, MOSFETs. The objective of this course is to gain an in-depth understanding of solid-state devices, in particular their non-ideal behaviors and electrical characterizations.

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

Part I: Semiconductor Materials and Solid-State Physics
  1. Energy band, energy vs. momentum diagram, and effective mass
  2. Density of states, Fermi-Dirac statistics, doping
  3. Drift and diffusion current, mobility and scattering
  4. Continuity equation (Midterm exam)

Part II: Solid-State Devices
  5. PN junction
  6. Schottky diode
  7. BJT
  8. MOS-capacitor and MOSFET (Final exam)
Part III: Material and Device Characterization

1. Resistivity: two-point versus four-point probe
2. Hall effect: carrier mobility and doping density
3. Carrier life time
4. Contact resistance and Schottky barrier
5. Current-voltage (I-V) and capacitance-voltage (C-V) measurement

(Graduate students presentation)

Required textbook


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


Homework and exam policy

- Homework is due in class. Late homework will NOT be accepted for any circumstances (no excuse policy).
- Exams will be completed individually in class (close book exams). No alternate exams will be provided except under dire circumstances.
- Discussion in small groups is encouraged for homework. However, each student should work through problems individually.
- Graduate students are expected to do additional work by providing research presentation during or at the end of semester.

Grading

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<th>Graduates (530)</th>
<th>Undergraduates (430)</th>
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<tr>
<td>Homework (approximately 5)</td>
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<td>Midterm exam</td>
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<td>Final exam</td>
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