**ECE 430/530 Solid-State Devices**

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

**Prerequisite:** PHY 253 and ECE 330

**Lectures:** MWF 2:00 pm - 2:50 pm, Houser Hall 309

**Office hours:** MW 11:00 am - 12:00 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 1)**

**Part II: Solid-State Devices**
5. PN junction  
6. Schottky diode  
7. BJT  
8. MOS-capacitor and MOSFET **(Midterm exam 2)**
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

(Term paper)

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 on term paper and presentation at the end of semester.

Grading

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<tr>
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<th>Graduates (530)</th>
<th>Undergraduates (430)</th>
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<tbody>
<tr>
<td>Homework (approximately 8)</td>
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<td>Midterm exam 1</td>
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<td>Term paper and presentation</td>
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