

**EEE 539 Introduction to Solid-State Electronics**  
**Fall 2019**

**Course Objective:** Develop an understanding of semiconductor crystal lattices, reciprocal lattices, lattice dynamics, electronic structure, electronic effects of impurities, semiconductor statistics, electron-phonon interactions, basic transport theory and application to semiconductors.

**Topics:**

- 1) Overview, semiconductor lattices, two-dimensional semiconductors (1 week)
- 2) Quantum mechanical basis (1 week)
- 3) Electronic structure, Brillouin zone (1 week)
- 4) Electronic structure, tight binding, empirical pseudopotentials (1 week)
- 5) Semiconductor energy bandstructure, alloys (1 week)
- 6) Low dimensional semiconductor materials (1 week)
- 7) Semiconductor statistics, equilibrium carrier concentrations (1 week)
- 8) Impurities, impurity statistics, free carrier concentrations (1 week)
- 9) Lattice dynamics and phonons (2 weeks)
- 10) Electron phonon interactions (1 week)
- 11) Scattering and transport in semiconductors (1 week)
- 12) Relaxation time approximation, mobility (1 week)
- 13) Semiconductor transport equations, solutions (1 week)

**Instructor:** Dr. Stephen M. Goodnick (ERC-552; 480-965-9572), skype: stephen.goodnick; email: [stephen.goodnick@asu.edu](mailto:stephen.goodnick@asu.edu)

**Class Schedule:** T-Th 4:30-5:45 am SS211

**Office Hours:** M 3:00-4:30, T 11:00-12:00, W 4:00-5:00, Th 9:00-10:00. For meetings outside regular office hours, please contact Robina Sayed, 480-965-9572; For online contact outside office hours, please use email, and I will respond when available and as promptly as possible.

**Prerequisites:** Basic background in electronic properties of materials

**Textbook:** David K Ferry, Semiconductors: Bonds and Bands, IOP Publishing Bristol UK, 2013, ISBN 978-0-750-31044-4 (ebook); ISBN 978-0-750-31045-1 (print) (PDF versions of the newest edition are posted on Canvas)

**Supplementary:** See the Canvas website for references and supplementary reading

**Midterm Exam:** Tuesday, Oct. 22<sup>nd</sup>

**Final Exam:** Thursday Dec. 12th 2:30-4:20pm

**Grading:** Homework/projects (50%); Midterm (20%), Final (30%); Homework and projects are expected to be your own work, copied material is not acceptable as per the ASU academic integrity policy, see below.

**Academic Integrity:** All students in this class are subject to ASU's Academic Integrity Policy (available at <http://provost.asu.edu/academicintegrity>) and should acquaint themselves with its content and

requirements, including a strict prohibition against plagiarism. All violations will be reported to the Dean's office, who maintain records of all offenses. Students are expected to abide by the FSE Honor Code (<http://engineering.asu.edu/integrity/>). The highest standards of academic integrity are expected of all students. The failure of any student to meet these standards may result in suspension or expulsion from the university and other sanctions as specified in the academic integrity policies of the individual colleges. Violations of academic integrity include, but are not limited to, cheating, fabrication, tampering, plagiarism, or facilitating such activities. Under no circumstances will violations of academic integrity be tolerated. Penalties include: reduced or no credit for submitted work, a failing grade in the class, a note on your official transcript that shows you were punished for cheating, suspension, expulsion and revocation of already awarded degrees. If you are not sure if something is allowed or not allowed, you should ask the course instructor.

**Disability Accommodations:** Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will require same. Such students must be registered with the Disability Resource Center and provide documentation to that effect.

**Sexual Discrimination:** Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>. As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish discuss any concerns confidentially and privately.