ECE 330 Introduction to Semiconductor Devices

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Course level: Undergraduate students

Prerequisite: ECE 225 and PHY 253

Lectures: TR 9:30am –10:45am, SERC, room 1056

Office hours: TR 10:45am – 11:45am

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)**

Part II: Semiconductor Devices

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

Required textbook and course pack

- Pierret, Robert F., *Semiconductor Device Fundamentals*, Addison-Wesley, c1996.
- *Course pack* (lecture notes) from University Supply Store

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

Homework discussion in small groups is encouraged. However, each student must *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* for any circumstances. Pop quizzes are possible to maintain class attendance and participation. Pop quizzes will count as a homework assignment in the grading process.

Rules for all in-class exams and quizzes

1. All quizzes and tests must be completed in class and all in-class work must be individual work. No assistance from classmates or anyone outside of class is allowed in any form. If ODS testing services are used, the test must be scheduled to be taken during the same time as the rest of the class.
2. Calculators cannot have internet or wireless access of any kind. You will not be allowed to share calculators.
3. Phones, watches, earphones, or any other personal electronic device is not allowed. All these devices must be turned off and placed out of sight during class. If such device is found during an in-class test, it will be treated as academic misconduct.
4. After the start of an in-class test, students are not allowed to leave the room for any reason. Once you leave the room, your test is over. No restroom or water breaks will be allowed. So, plan accordingly.
5. During an in-class assignment, students may be asked to sit in a specific location, may be moved from one seat to another, asked to stand up, asked to roll up their sleeves, and asked to empty their pockets to verify they are not concealing electronic devices. Failure to abide by these requests will constitute academic misconduct. The instructor can also take photos and video of the class during an assignment that can and will be used to enforce the academic integrity of the classroom (these videos will not be used for any other reason).

Grading

Homework, weekly ……..……30%
Midterm exam ……..……30%
Final Exam ……..... 40%

Academic Misconduct Policy

Academic misconduct includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student. All students in attendance at The University of Alabama are expected to be

honorable and to observe standards of conduct appropriate to a community of scholars. The University of Alabama expects from its students a higher standard of conduct than the minimum required to avoid discipline. When enrolled at The University of Alabama, students are expected to abide by the Academic Honor pledge. Additionally, at the discretion of the course instructor, each student will be expected to sign an Honor Pledge which reads as follows:

"I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedures that will result from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University."

See the Academic Misconduct Policy for more information (https://catalog.ua.edu/undergraduate/about/academic-regulations/student-expectations/academic-misconduct-policy/). The Academic Misconduct Disciplinary Process will be followed for all academic misconduct cases.