Course: ECE 344 Semiconductor Devices and Materials

Lecture: Zlatan Aksamija (zlatana@engin.umass.edu)
Discussion: Jinhua (Joshua) Yang (jjyang@umass.edu)
Homework TA: Arnab Majee (amajee@engin.umass.edu)

Meeting Times: Lectures MWF 11:15 am -12:05 pm in ELab 303
Discussions: Tu OR Thu 10:00 – 11:15 am in Hasbrouck Lab 137

Office Hours: Lecture: 201B Marcus Hall, times M and W 1-2 pm
Discussion: 201G Marcus Hall, times Tue and Thu 1-2pm
Homework TA: TBD

Description: Introduction to the quantum theory of solids and conduction processes in semiconductors. Theory of p-n junction diodes, bipolar junction transistors (BJTs), metal-oxide-semiconductor (MOS) system, and field-effect transistors (FETs). Overview of advanced topics including post-CMOS devices, and integrated circuits (ICs).

Course Goals:

- To understand the physical structure and electrical properties of semiconductor materials.
- To master the fundamental concepts and equations of semiconductor device analysis, and apply them to the description of semiconductor junctions and structures.
- To understand how the terminal characteristics of junction diodes, bipolar transistors, and field-effect transistors derive from device structure and material properties.

Required Textbook: Semiconductor Device Fundamentals by Robert F. Pierret
http://umass.amazon.com/dp/0201543931/ref=umass_coursecatalog

Textbook/Reading Policy: this is a challenging course covering a very broad array of topics and building up semiconductor physics fundamentals from scratch before moving on to device applications. The first half of the course is especially challenging to most ECE students because of the lack (complete absence) of modern physics, quantum physics, and physical chemistry in our curriculum. For this reason, reading the textbook is a must; the text was carefully selected for being the clearest and easy-to-read offering in the semiconductor area. Please read the corresponding section/chapter before each lecture/week in order to keep up with the material. Lectures slides contain equation numbers corresponding to numbers in the textbook—this is an easy way to keep up with the sections of the book being covered in the lecture.

Webpage: the course uses Moodle for notes, announcements, and questions/discussions. Powerpoint slides of the lectures will be uploaded after each section of the course. Any additional lecture materials used in lectures will also be provided in Moodle.

Video Recordings: lectures are being recorded using UMass ECHO360 software. Lecture videos containing PPT slide, blackboard video and lecture audio will be posted via a link in Moodle; however, this process will not be immediate. There may be a several week delay between recording and the lecture video being ready to post; in addition, not all lectures are guaranteed to be made available.

Assignments: weekly homework, discussion quizzes, midterm/final exams

- Approx. 10 homework assignments, each corresponding to a chapter we cover, assigned on a (roughly) weekly schedule worth 20% of the total grade. Homework assignments are due at the beginning of class on the due date. No late homework will be accepted under any circumstances. HWs will be a mix of problems from the textbook, instructor-generated problems, and problems from past exams for practice.
- 5 Discussion quizzes (roughly) every two weeks. Quizzes will be around 20 minutes, given in both discussions sections. Best 4 quiz scores count 20% of the total grade.
- In addition to quizzes, there will be a discretionary 5% of the grade from discussion attendance and participation based on solving discussion problems.
- Mid-term exam will be held on **Thursday October 27th in the evening (7-9pm) in ELab 303**. The discussions on Oct. 25 and 27 will be used for midterm review. The mid-term is worth 20% of the total grade.
- The final exam will be held **Friday, Dec. 16th from 10:30 am to 12:30 pm in Goessman Lab room 20**. There will be a final review earlier that week (time and location TBD). The final will be cumulative and worth 35% of the total grade.
- Make-up exams will be given only if you provide a valid written excuse (as defined in Undergraduate Rights and Responsibilities) and notify me *prior* to the missed exam. Other missed exams will be considered failures.

Course Inclusivity Statement: "The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing or speak with Dr. Paula Rees, Director of Engineering Diversity Programs (rees@umass.edu, 413.545.6324, Marston 128). We are all members of an academic community where it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect."