ECE 609 – Semiconductor Devices
Department of Electrical and Computer Engineering
University of Massachusetts at Amherst

Spring 2013

Day & Time: MWF, 10:10 – 11:00
Place: Marston 211
Instructor: Prof. Neal G. Anderson (201B Marcus, anderson@ecs.umass.edu)
Office Hours: See course web site (Moodle)

Course Description
Operational principles of canonical electronic devices described in terms of material properties, equilibrium and nonequilibrium processes, interface and junction characteristics, and device structure (dimensions and geometry). Contemporary devices (or device-related phenomena) of interest to individual students are explored through independent course projects.

Preliminary Course Outline

1. Overview of Semiconductor Physics
   1.1 Semiconductor Materials and their Microscopic Structure
   1.2 Energy Bands and Electron and Hole Effective Masses
   1.3 Density of States, Occupation Statistics, and Equilibrium Carrier Concentrations
   1.4 Beyond Equilibrium: Excess Carriers and Carrier Transport

2. Junctions and Interfaces
   2.1 p-n Junction (Equilibrium Characteristics, I-V Characteristics, Nonideal Behavior)
   2.2 Metal Semiconductor Junctions (Schottky Barriers, Ohmic Contacts)
   2.3 Metal-Oxide-Semiconductor (MOS) Capacitors

3. MOSFET Devices
   3.1 MOSFET Structure and Operation
   3.2 Ideal MOSFET: I-V Characteristics and Transconductance
   3.3 Nonideal/Secondary Effects

4. Bipolar Junction Transistors (BJTs)
   4.1 BJT Structure and Operation
   4.2 Ideal BJT: I-V Characteristics and Current Gain
   4.3 Nonideal/Secondary Effects

5. Special Topics and Contemporary Issues (as time permits)
Course Materials

Lectures and lecture notes are the primary course materials.

Recommended Text


Useful Reference Texts

Graduate Level


Undergraduate Level


Grading

Homework - 10%
Midterm Exam - 30%
Final Exam - 30%
Course Project – 30%

Updated 1•16•13