

EE 3161 – Semiconductor Devices

Spring 2008

Time: MWF 11:15 – 12:05

Place: Physics 166

Instructor: Joey Talghader
EE/CS 5-165
625-4524

Office Hours: Wednesday 12:15-1:45
Friday 12:15-1:30

Recitations:

TBA	Tuesday	1:25-2:15	Amundson 156
Sang-Hyun Oh	Tuesday	2:30-3:20	Amundson 120
J. Talghader	Wednesday	2:30-3:20	EE/CS 3-115
TBA	Wednesday	3:35-4:25	Amundson 156

TA: Merlin Mah
EE/CS 2-121
mahx0004@umn.edu

Office Hours: Thursday 2:15-3:30

Textbooks: Required: Semiconductor Device Fundamentals, R. Pierret

Other Useful Texts: **Device Electronics for Integrated Circuits, R. Muller and T. Kamins**
Solid-State Electronic Devices, B. Streetman and S. Banerjee
Devices for Integrated Circuits, H. Casey

Grading: 15% Homework
25% Midterm 1
25% Midterm 2
35% Final

Homework and Exams: Homework sets will generally be handed out every 7-10 days and will be due approximately one week afterwards. Homework solutions will be handed out in class on the due date of the homework. There will be two midterm exams and a final, and the exam format will be open book/open notes. You may use a calculator, but obviously no cell phones or other communication devices are allowed! The registrar has set our final exam date to be Tuesday, May 13, 8:00-10:00. As usual, any exam absences must be accompanied by a doctor's excuse. If an exam is missed with such an excuse, we will just make the final worth more to cover the lost exam.

Emails: At the moment the class enrollment looks like it will be about 80 students. With this large of a class size, I honestly don't think I will be able to answer content-heavy questions by email. Yes/No questions are fine, but it takes a very long time to write out the answers to even simple questions like "What did you mean by 'uncompensated' in

homework problem #3?" Please drop by during office hours or feel free to come to the front after lecture, and I will be very happy to spend all the time necessary to answer your questions.

University of Minnesota Scholastic Guidelines:

<http://www.fpd.finnop.umn.edu/groups/senate/documents/policy/classexpectguide.html>

COURSE OUTLINE:

0. History of the Transistor

I. Semiconductor Physics

- What is a Solid?
- From Atom to Semiconductor
- Carriers in Equilibrium
- Carrier Transport

II. Diodes

- Definitions and Introduction
- Carriers, Fields, and Potentials in Diodes
- Ideal Diode Behavior
- Deviations from Ideal
- Charge Storage and Transient Behavior

III. Bipolar Junction Transistors (BJTs)

- Transistor Action and Regions of Operation
- I-V Equations and Behavior
- Shortcomings of Ideal Mode

IV. Metal-Oxide-Semiconductor Field Effect Transistors (MOSFETs)

- MOS Capacitor: Energy Band Structure
- MOS Capacitor: Capacitance-Voltage Behavior
- MOS Capacitor: Threshold Voltage Behavior
- MOS Transistor: Current-Voltage Basics
- MOS Transistor: I-V Behavior and Model Adjustments
- MOS Transistor: MOSFETs in Practice