Course Syllabus

EEE 3396c Solid State Electronic Devices
(Fall, 2017, MWF 6, LAR 330)

**Goals:** To present the theoretical and practical background of device physics so that students understand and are able to design and optimize the charge transport properties of semiconductor materials and devices.

**Instructor:** Dr. Jing Guo (NEB 551, guoj@ufl.edu)

**TA:** Megan Tillman (mltillman@ufl.edu), Zhipeng Dong (zhipengdong2@gmail.com)

**Text (required):**

**References:**
Semiconductor Device Fundamentals
Pierret, Robert F.
Addison-Wesley, 1996

**Office hours:**
Dr. Guo: 2-4pm, Monday or by email appointment (NEB551), Email: guoj@ufl.edu

TA: Megan Tillman (Office: NEB222): office hour: Monday 4th period (10:40-11:30), Email: mltillman@ufl.edu (mailto:mltillman@ufl.edu), Zhipeng Dong(Office: NEB503): office hour: Monday (16:05-16:55) Email: zmisha@ufl.edu

**Topics:**
Crystal Properties of Semiconductors - Chap. 1
Semiconductor materials
Crystal Lattices
Charge Carriers in Semiconductors - Chap. 3

Energy Band Model
Bonding Model
Carrier Energy Distributions
Carrier Concentrations
Fermi Level in Equilibrium
Carrier Drift in Electric Fields

Excess Carriers in Semiconductors - Chap. 4

Optical Absorption & Recombination
Carrier Lifetime & Photoconductivity
Quasi-Fermi Levels
Carrier Diffusion
Drift & Diffusion
Einstein Relation

Junctions - Chap. 5

Contact Potential
Forward & Reverse Bias
Diode Equation
Reverse Bias Breakdown
Junction Capacitance

Field-Effect Transistors - Chap. 6

MOSFET Basic Concepts
Ideal MOS Capacitor
Threshold Voltage
Capacitance vs. Gate Voltage
Real Surface Effects
MOSFET Voltage/Current Relations
Frequency Response

Bipolar Junction Transistors-Chap. 7

https://ufl.instructure.com/courses/344089/assignments/syllabus
BJT Basic Concepts
Current Distribution Diagrams
Emitter Injection Efficiency
Current Amplification Factor
Base Charge Transit Time/Lifetime
Common Emitter Amplification
Heterojunction Bipolar Transistor

Optoelectronic Diodes - Chap. 8
Photodetectors
Solar Cells
Light Emitting Diodes (LEDs)

**Labs (NEB 289, MW, 7-8 periods, Lab attendance, lab quiz and lab report required)**

1. Lab on bandstructure of semiconductor materials (**week of Sep. 11**)
2. Lab on fabrication technology and process simulation (**week of Sep. 25**)
3. Lab on PN junction (**week of Oct. 9**)
4. Lab on LED (**week of Oct. 23**)
5. Lab on Metal-Oxide-Semiconductor Capacitors (**week of Nov. 13**)
6. Lab on MOSFETs. (**Week of Nov. 27**).

**Grading:**

1. Exams (75% in total):

Tests I, II, and III are in class and count for 25% each, but only the two highest scores will be used. You may skip one exam.

The final exam (scheduled on 12/13/2017, 12:20-2:30) is **required** and counts for 25%. Make sure you don't have any schedule confliction with the final exam before taking the course.

**Exam Dates:**

Exam I: Sep. 20
Exam II: Oct. 18
Exam III: Nov. 15
Final: Dec. 13

2) Lab quiz, attendance and reports (15% in total)
Lab quiz, attendance, and reports count for 15%.

3) Quizzes (10% in total)
There are about 7 in-class quizzes. These quizzes are likely to be given on the Wed. sessions. The five quizzes with the highest scores will be counted.

Homework answers will be posted in the course e-learning website. The homework problems will not be graded. You are highly encouraged to work out the homework problems and check the solutions, as they are related to quizzes and exams.

The overall class average will determine the B- B breakpoint. The A range will start one standard deviation above this point, the C- range one standard deviation below.

4) Bonus points (4% in total)
We will arrange four in-class quizzes for bonus points. The quizzes for bonus points can be given in any session. Each quiz consists of 5 multiple-choice questions. The quizzes on the go will be handed out at the beginning of the class, and collected at the end. If you pay attention, the answer is in the lectures. Each quiz counts for 1 percent of the total cumulative score. You can earn up to 5 percent if you attend all lectures on quiz days and get the answer right. No makeup is allowed.

These bonus points are extra. You can use the extra bonus points to lift your grade.

5) Make-up Exam and Quiz Policy
If you have a University-approved excuse and arrange for it in advance, and you have to miss at least two Tests of Tests I, II, and III (since there is already a built-in makeup mechanism by counting two out of three), a make-up Test will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. The student must submit a written petition to the instructor one week prior to the scheduled exam and the instructor must approve the petition. The makeup Test will be comprehensive and arranged in the final week, with an equal or greater difficulty level.

If you have University-approved excuse to miss at least three out of seven quizzes and obtained approval in advance for each (since there are already two quizzes not counted built in), a make-up Quiz will be allowed and arrangements can be made for making up missed work. All makeup Quiz will be arranged after the last Quiz, with an equal or greater difficulty level.

Partial credit:
The following policy for test and quiz partial credit applies.

1. All requests for partial credit should be directed, in writing and documented, to Prof. Jing Guo within one week after the work has been returned.
2. You will only receive credit for work handed in for grading.
3. You can not receive full credit for wrong answers.

**Academic Honesty Statement:**

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

**Course Summary:**

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