

Course Syllabus

EEE 3396c Solid State Electronic Devices

(Fall, 2018, 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 \(mailto:guoj@ufl.edu\)](mailto:guoj@ufl.edu).)

TA: Nathan Miller ([nmiller95@ufl.edu \(mailto:nmiller95@ufl.edu\)](mailto:nmiller95@ufl.edu)),

Tong Wu (wutlz2012@gmail.com)

Text (required):

"Solid State Electronic Devices," 7th Edition by Ben Streetman and Sanjay Banerjee, published by Pearson, Prentice Hall

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: TBD: Nathan Miller, Tong Wu

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

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, Lab attendance, lab quiz and lab report required)

Lab sections: Lab section 1: R 9-10 (NEB 289) Lab section 1: M E2-E3 (NEB 289) Lab section 3: T 11-E1 (NEB 289)

- (1) Lab on bandstructure of semiconductor materials
- (2) Lab on fabrication technology and process simulation
- (3) Lab on PN junction
- (4) Lab on Metal-Oxide-Semiconductor Capacitors
- (5) Lab on MOSFETs.

(6) Lab on LED

Grading:

(1) Homework (15%): 7 homework sets, highest 6 count.

(2) Labs (20%): 6 labs, highest 5 count

Lab quiz, attendance, and reports are required.

(3) Midterm Exam (30%), in class, **Oct. 24, 2018**

(4) Final Exam (35%): **3:00-5:00pm, Dec. 13, 2018.**

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.

5) Make-up Exam and Quiz Policy

University attendance policies can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

[\(https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx\)](https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx). If you have a University-approved excuse and arrange for it in advance, a make-up Test will be allowed and arrangements can be made for making up missed work. 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.

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:

Date

Details
