

**Solid-State Devices**  
EEE 3396C Sections 12083-5

**Class Periods: Lectures (location: NEB 202):**

Tuesday 2<sup>nd</sup>, 3<sup>rd</sup> (8:30 – 10:25)

Thursday 3<sup>rd</sup> (9:35 – 10:25)

**Lab (location: NEB 289):**

Section 12083: Thursday 11<sup>th</sup> – E1 (6:15 – 8:10 pm)

Section 12084: Wednesday E2 – E3 (8:20 – 10:10 pm)

Section 12085: Monday 9<sup>th</sup> – 10<sup>th</sup> (4:05 – 6:00 pm)

**Academic Term:** Spring 2020

**Instructor:**

Prof. Henry Zmuda

[zmuda@ece.ufl.edu](mailto:zmuda@ece.ufl.edu)

Office Phone Number: (352) 392 – 0990

Mobil Phone Number: (850) 225 – 9200 text me anytime, voice calls for emergencies only please

Office Hours: TBA, or immediately after class, by e-mail, or appointment

**Teaching Assistant:**

Please contact through the Canvas website

Colleen Weller, [colleenweller@ufl.edu](mailto:colleenweller@ufl.edu), Office Hours: TBA

**Supervised Teaching Student:**

Shayla Breedlove, [s.breedlove@ufl.edu](mailto:s.breedlove@ufl.edu), Office Hours: TBA

**Course Description**

Introduces the principles of semiconductor electron device operation. Laboratory.

**Course Pre-Requisites / Co-Requisites**

EEL 3008

**Course Objectives**

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.

**Materials and Supply Fees**

The Analog Discovery (DAD) board or National Instruments Analog Discovery (NAD) board is REQUIRED for this course (and many other ECE courses). Board ordering information for the DAD can be found at: <http://store.digilentinc.com/analog-discovery-2-100msps-usb-oscilloscope-logic-analyzer-and-variable-power-supply/>. Board ordering info about the NAD can be found at <http://sine.ni.com/nips/cds/view/p/lang/en/nid/213328>. For those who wish to use financial aid or want it right away, the bookstore will be carrying the NAD at a slightly elevated price.

Add'l Course Fees: \$2.75

**Professional Component (ABET):** 4 credits of Engineering Science

### **Relation to Program Outcomes (ABET):**

<b>Outcome</b>	<b>Coverage</b>
1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	High
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
4. An ability to communicate effectively with a range of audiences	Low
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Low
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	High
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	Low

### **Required Textbooks and Software**

- Solid State Electronic Devices, 7<sup>th</sup> edition
- Ben Streetman and Sanjay Banerjee
- Publisher: Pearson
- ISBN: 0133356035
- Other course materials, including lecture notes, problem sets and solutions, and exam solutions will be posted online on the course webpage. No hardcopy handouts will be given out.

### **Course Schedule**

Weeks 1-2:	Chapter 1: INTRODUCTION TO SEMICONDUCTOR MATERIALS
Week 3:	Chapter 2: ATOMIC STRUCTURE AND THE PERIODIC TABLE Exam 1
Weeks 4-5:	Chapter 3: ENERGY BANDS AND CHARGE CARRIERS IN SEMICONDUCTORS
Weeks 6-7:	Chapter 4: EXCESS CARRIERS IN SEMICONDUCTORS (THE CONTINUITY EQUATION) Exam 2
Weeks 8-9-10:	Chapter 5: p-n JUNCTIONS
Weeks 11-13:	Chapter 6: METAL-OXIDE-SEMICONDUCTOR FIELD EFFECT TRANSISTOR (MOSFET) Exam 3
Weeks 14-15:	Chapter 7: BIPOLAR JUNCTION TRANSISTOR (BJT) Final Exam (Cumulative)

### **Attendance Policy, Class Expectations, and Make-Up Policy**

Attendance is required in both lecture and lab. Attendance will be taken via i-clicker and counts toward the final

grade. Two (2) unexcused absences are allowed for the semester. A five-minute grace period from the start of class is allowed after which the student is absent. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. The use of electronic devices (cell phones, tablets, laptops, etc., is not allowed). A student who does not observe this will be marked absent. All students MUST post a recognizable photograph of their face on the Canvas web page. An attendance grade of zero (0) will be issued if an acceptable photograph is not posted. Late Policy for homework and labs reports is as follows: Assignments are due by midnight of the assigned date. After midnight: One day late – 25% reduction in grade; Two days late – 50% reduction in grade; Three days late – 75% reduction in grade; More than three days late – no credit given. Students should notify the instructor if an emergency arises which can result in a late submission of an assignment. For an emergency, send a text message to the instructor as soon as possible. Exceptions to this policy for late work will be at the discretion of the instructor. Make-up exams are given for an excused, documented reason. In fairness to other students, the make-up will, in general, be of greater difficulty than the original exam to account for the extra preparation time.

### **Evaluation of Grades**

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Attendance (2 unexcused absences allowed)	10	10%
Homework	10	10%
Weekly Quizzes (2 lowest grades dropped)	10	10%
Three (3) in-class Exams, lowest grade dropped	100	20%
Lab Reports	10	20%
Final Exam	100	30%
<b>Total</b>		<b>100%</b>

**Grading Policy: Final letter grades will be assigned based on a curve.**

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

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

### **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **Course Evaluation**

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Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

**Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

**Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** <https://care.dso.ufl.edu>

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.