

# Course Syllabus

**EEL 4248/5249 Fundamentals of RF and Power Electronic Devices**

**(MWF 6<sup>th</sup> period, 12:50-1:40, LAR329, Spring 2022)**

***Instructor:***

Dr. Jing Guo

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Class Web site: UFL elearning canvas website

Office Hours: 9-10am, Mon. (Zoom: <https://ufl.zoom.us/j/9976443936> (Links to an external site.) (Links to an external site.) Meeting ID: 997 644 3936)

**Course Description:**

The course is designed to introduce important semiconductor device technologies for high speed electronics, power electronics and energy harvesting applications. The students are expected to develop fundamental understanding on the device physics of the most important semiconductor devices for these applications, and develop the capability to analyze device characteristics based on fundamental device theories. The students are also expected to appreciate the technological applications of the devices.

**Course Pre-requisites:**

Students are expected to have already completed an introductory level device course at the undergraduate level, such as EEE3396c here at UF or any equivalent course at other institutes.

***Recommended Materials***

- Class notes and handouts
- "Fundamentals of Power Semiconductor Devices," J. Baliga, Springer Sciences, 2008 (full text downloadable from UF library full text link).
- "Semiconductor Device Physics and Design," U. Mishra and J. Singh, Springer (for reference)
- "Modern Semiconductor Devices for Integrated Circuits," Chemning Calvin Hu, Prentice Hall, 2009 (for reference).

**Topics:**

1. Semiconductor material and PN junction
2. PIN power diodes
3. Solar cell for energy harvesting
4. Bipolar Junction Transistor (BJT)
5. Heterojunction bipolar transistor (HBT) for RF electronics
6. MOS capacitor and MOSFET
7. Power MOSFET
8. High Electron Mobility Transistor (HEMT) for RF electronics
9. IGBT for power electronics
10. Exam
11. Lab Sessions: (PIN power diode lab, BJT lab)

### **Grading:**

- 10% homework and in-class quizzes.
- 35% Midterm Exam: The exam is based on class notes including oral comments, problems solved in classroom and homework and quiz problems. The students are responsible for the above materials.
- 20% Research paper presentation: Each student will choose a research paper, preferably related to their term project, in the field of power and RF electronic device technologies and present it in class. The presentations will be graded based on 1) the presenter's ability to clearly describe the problem, explain the solution, and evaluate the (experimental or simulation) results, 2) the quality of answers provided to the questions, and 3) the content of the slides.
- 35% Project: It consists of 30% final presentation, and 5% peer review participation.

Final presentation: Half of the final presentation should be overview of the research field for the project, and the other half shall clearly identify a problem, perform calculation, modeling, or simulation, and reach your own conclusion on the memory device studied in the project.

**Attendance Requirements:** As this course will have in class quizzes and assignments, consistent attendance is very important. Perfect class attendance is not required, but very consistent participation is expected. It will be tracked through participation in the in-class quizzes and assignments. There is no make-up for in-class quizzes and assignments.

**Make-Up Exam Policy:** If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed exam. 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 two weeks prior to the scheduled exam and the instructor must approve the petition.

### ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/> (Links to an external site.). It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### ***Course Evaluation***

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/> (Links to an external site.). 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/> (Links to an external site.). Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/> (Links to an external site.).

### ***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/> (Links to an external site.)) 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>