

1. Catalog Description – (3 credits) The overall goal is to provide students with knowledge in semiconductor material characterization and device fabrication techniques.
2. Pre-requisites and Co-requisites: None
3. Course Objectives -
 - a. Students will gain knowledge in semiconductor based processes, units, and corresponding equipment.
 - b. Students will gain knowledge in to design and fabricate the devices.
 - c. Students will be able to use the scientific method and problem solving strategies, as well as statistical methods, to design and carry out experiments in order to solve engineering problems.
 - d. Students will demonstrate familiarity and experience with the capabilities and limitations of semiconductor process equipment.
 - e. Students will understand and practice safe laboratory and chemicals-handling principles.
 - f. Students will be able to integrate topics from various semiconductor processing steps to solve realistic problems in the areas of material and device characterization.
 - g. Students will exhibit critical and creative thinking skills for analysis and evaluation of problems and cause-effect relationships.
 - h. Students will be able to obtain and evaluate appropriate informational/data from databases, handbooks, correlations, experiments, literature, etc.
 - i. Students will be able to rationalize units, make order of magnitude estimates, assess reasonableness of solutions, and select appropriate levels of solution sophistication.
 - j. Students will demonstrate effective reading of technical material.
 - k. Students will demonstrate effective interpretation of graphical data.
 - l. Students will practice good teamwork principles.
 - m. Students will gain general concepts of estimating mass-transfer coefficients and use them to determine mass-transfer rates across phase boundaries during oxide growth.
 - n. Students will demonstrate knowledge of photolithographic chemistry.
 - o. Students will understand fundamentals of vacuum deposition including thermal evaporation and sputtering deposition systems.
4. Contribution of course to meeting the professional component: N/A
5. Relationship of course to program outcomes: N/A
6. Instructor - Fan Ren

- a. Office location: CHE 427
 - b. Telephone: 352-392-4727
 - c. E-mail address: ren@che.ufl.edu
 - d. Office hours: Monday 9:30-10:30 and Tuesday 8:30-10:00 AM
7. Class: 2nd period on Monday, Wednesday, Friday.
8. Software Required – SRIM and Layout Editor

- (a) Download the SRIM-2013 (Professional) software from <http://www.srim.org/SRIM/SRIMLEGL.htm>. Download the file and follow the procedures indicated on the website but when you rename the file “SRIM-2013-Pro.e” use the name ZIP.exe to avoid confusions later. **Please make sure your windows language and version are English.**

After extracting the file open the “SRIM-Setup” folder. Right click on the “_SRIM-Setup (Right-Click).bat” and select “Run as administrator”. Follow indicated procedures.

Go back to the uncompressed folder and open the “SRIM.exe” file (this is the software link). Be sure you can access the Stopping/Range table and also the TRIM Calculation window and they appear complete on the screen.

- (b) Download “layout editor” from the link below from <http://www.layouteditor.net/download.html> and install it.

9. Recommended Reading -

Stephen A. Campbell, The Science and Engineering of Microelectronic Fabrication, Second Edition ed.: Oxford University Press, 2001.

Dieter K. Schroder, Semiconductor material and device characterization, Third Edition ed.: John Wiley & Sons, Inc., 2006.

G.S. May and S.M. Sze, Fundamentals of semiconductor fabrication.: Wiley, 2004.

10. Course Outline (provide topics covered by week or by class period) –

1. Semiconductor Growth
2. Crystalline of semiconductor and x-ray
3. Four point measurement, transmission line method, Schottky diode characterization, Hall Measurement

4. Photolithography
5. Field effect transistor and bipolar transistor model and characterization
6. Mask design
7. Ion implantation
8. Wet and plasma etching
9. Oxide growth
10. Evaporation, sputtering and CVD deposition system
11. Surface and material analyses; SIMS, RBS, Auger, XPS, X-ray
11. Vacuum technology; vacuum pumps and vacuum gauges
12. MOS diode characterization; oxide breakdown strength, carrier concentration and interface trap density measurements
13. Presentation

11. Grading – methods of evaluation (3 exams 75%, homework 15%, presentation 10%)

Grading Scale (e.g., 85-100 A, 80-84 A-, 75-79 B+, 70-74 B, 65-69 B-, 60-64 C+ etc.)

12. 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 work. University attendance policies can be found at:

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

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

13. Honesty Policy – 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 UF student and to be honest in all work submitted and exams taken in this course and all others.

“...failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures

<http://www.dso.ufl.edu/sccr/procedures/honorcode.php>)

14. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will

provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

15. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
 - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
 - Career Resource Center, Reitz Union, 392-1601, career and job search services.

16. Software Use – All faculty, staff and student 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.