

ADVANCED ELECTRONIC MATERIALS PROCESSING

EMA 6616/ 4614

1. Description: This is a 3 credit graduate class. The goal is to give an overview of the properties of semiconductor and related material for particular applications, and some detail of individual processing steps such as lithography, etching, deposition, implantation, annealing and oxidation. Some basic electronic and photonic devices such as bipolar transistors, metal-semiconductor field effect transistors, metal-oxide semiconductor field effect transistors, diode lasers and light-emitting diodes will be discussed. Examples of current individual and integrated processes will also be covered.

2. Pre-requisites and Co-requisites: None, but some knowledge of semiconductor physics is assumed.

3. Course Objectives: To provide the student with an up-to-date picture of how modern semiconductor chips are fabricated; comparison of Si versus compound semiconductors; processing modules such as diffusion, ion implantation, wet and dry etching and metal deposition; materials selection requirements; yield and reliability requirements; basics of component devices such as MOSFETs, bipolar transistors, LEDs and laser diodes.

4. Contribution of course to meeting the professional component.
This is a 3 credit course elective offered to students in the electronic materials specialty of the MSE program. It provides 3 credits towards Engineering Sciences.

5. Relationship of course to program outcomes.

This course addresses the following MSE Program outcomes:

(a) To apply mathematics, science, engineering basics and the fundamentals of materials science to envision solutions to and to solve engineering problems. (High coverage)
This course builds on fundamental concepts learned in previous courses and applies them to materials processing. Students are assigned homework and exam problems in which they must describe appropriate applications of the various processing techniques.

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Office Hours: 9.00-10.00 pm Monday & Wednesday

7. Teaching assistants-there are generally none assigned to the class.

8. Lecture times MWF, 10.40-11.30 AM

9. Lecture location: EDGE studios CSE E118

10. There are no material or supply fees

11. Text: Fabrication Engineering at the Micro- and Nanoscale, Stephen A. Campbell, fourth edition, Oxford University Press, 2013, ISBN 978-0-19-986122-4 (available in the University Bookstore in paperback edition).

There is a Sakai System page for the course containing additional relevant material, including lecture notes, solution sets from the text book and semiconductor videos
<https://lss.at.ufl.edu/>

12. Course Outline

Lecture	Day/Date	Topic	Assigned Problems
1	Wednesday, 8/21	General Introduction	
2	Friday, 8/23	Properties of Semiconductors	
3	Monday, 8/26	Video(Microchip)	
4	Wednesday, 8/28	Properties of Semiconductors	1-3
5	Friday, 8/30	Bulk Growth	
-	Monday, 9/02	Labor Day-no class	
6	Wednesday, 9/04	Epitaxial Growth	
7	Friday, 9/06	Epitaxial Growth	
8	Monday,9/09	Growth and characterization	
9	Wednesday, 9/11	Video (GaAs/MBE)	
10	Friday, 9/13	Characterization	
11	Monday, 9/16	Lithography /(Video Lithography)	
12	Wednesday, 9/18	Lithography	
13	Friday, 9/20	Wet Etching	
14	Monday, 9/23	Dry Etching	
15	Wednesday, 9/25	Video (Si Run I)	
16	Friday, 9/27	Quiz #1	****
17	Monday, 9/30	Dry Etching (Video Etch)	
18	Wednesday, 10/02	Deposition(Video Deposition)	
19	Friday, 10/04	Video (Si Run II)	4-6
20	Monday, 10/07	Implantation	To be distributed
21	Wednesday, 10/09	Implantation(Video Implantation)	
22	Friday, 10/11	Quiz #2	****
23	Monday, 10/14	Diffusion	
24	Wednesday, 10/16	Diffusion	
25	Friday, 10/18	Video (Overview of Semiconductor Manuf))	
26	Monday, 10/21	Annealing	
27	Wednesday 10/23	Video -Front end IC manufacture	

28	Friday, 10/25	First Exam	****
29	Monday, 10/28	Contacts	
30	Wednesday, 10/30	Contacts	
31	Friday, 11/01	Process Integration/MOSFET	
32	Monday, 11/04	Video (Gate Dielectrics)	
33	Wednesday, 11/6	Video (Testing)	
-	Friday, 11/08	Homecoming (no class)	
-	Monday, 11/11	Veteran's Day (no class)	
34	Wednesday, 11/13	MESFETs/HEMTs	
35	Friday, 11/15	HBTs	
36	Monday, 11/18	LEDs	
-	Wednesday, 11/20	Video (300mm challenges)	
-	Friday, 11/22	Video (Interconnects)	
37	Monday, 11/25	Detectors	
38	Wednesday, 11/27	Thanksgiving (no class)	
39	Friday, 11/29	Thanksgiving (no class)	
40	Monday, 12/02	Review of class	
41	Wednesday, 12/04	Second Exam (optional date) ^{***}	****

*** to be decided by consultation with students. Individuals may schedule taking the exam at other times.

13. Attendance and Expectations (is attendance required, penalties for absence, tardiness, cell phone policy, etc.). Attendance at the lectures is not required, but experience has shown it is more beneficial to the student's understanding of the course materials. If you attend the lectures, be prompt in your arrival as a courtesy to the other students. Cell phones must be turned off during lectures.

14. Grading: Quizzes (2) 30%
 First Exam 30%
 Second Exam 40%

15. Homework: Optional, but any serious student will do it.

16. Grade Scale: 90-100% A 85-89% B⁺
 80-84% B 75-79% C⁺
 65-74% C 61-64% D⁺
 56-60% D 0-55% F

Grades are absolute and are not curved

17. Make-up Exam Policy .Reasonable excuses will be entertained for absences from exams or quizzes and the student will be expected to take the exam as soon as possible after it was originally scheduled.

18. 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.

19. 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.

20. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

21. 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.