

EE4353/4153, VLSI Nanotechnology
EE5318/5118, Electronic Materials Processing
Spring 2019
University of Texas at El Paso

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| Instructor: | David Zubia, Ph. D. | Office Hours: |
| Office: | 335 Engineering Annex | M 10:30-12:00, W 10:30-12:00 |
| Voice: | 747-6970 | Other hours by appointment |
| Email: | dzubia@utep.edu | |

Course Description:

This course deals with the science and technology needed to fabricate semiconductor devices. The course will include lectures, hands-on laboratories and computer simulations. The course will cover important fabrication processes needed to manufacture electronic devices including; Diffusion, Thermal Oxidation, Ion Implantation, Rapid Thermal Processing, Lithography, Etching and, Thin Film Deposition. The relationships between manufacturing conditions, structure and performance will be highlighted for each process to gain a deeper appreciation of each process. Emphasis is placed on conceptual understanding and problem solving.

Semiconductors and electronic devices are used in circuits to make complex analog and digital functions such as amplifiers (for audio, high-frequency, wireless, etc) and microprocessors. This course is fundamental to the manufacturing of electronic devices and will benefit persons from different backgrounds including, physics, chemistry, materials science, mechanical engineering and electrical engineering.

Topic for Graduate Students:

Graduate students will be part of an “advanced fabrication team”. The Advanced Team will have the task of assisting the Teaching Laboratory Assistant. This might require the Advanced Team to learn the material ahead of the rest of the class to assist the TA and instructor with fabrication procedures during scheduled labs.

Learning Objectives:

After completion of this course, students should be able to:

- Understand the principles of fabrication processes including; Crystal Growth, Substrate Preparation, Diffusion, Thermal Oxidation, Ion Implantation, Lithography, Etching, and Thin Film Deposition.
- Apply the principles of fabrication processes and their integration to create functional semiconductor structures.
- Apply concepts important to efficient fabrication of semiconductor devices including Yield, Statistical Process Control, and Design of Experiments.
- For Graduate Students: Setup of laboratory experiments and assist with fabrication of semiconductor devices.

Required Textbook:

Semiconductor Devices: Physics and Technology, 3rd Edition, S. M. Sze and M. K. Lee, Wiley, 2012

Course Work Evaluation:

| | <u>Value</u> |
|-----------------|--------------|
| Problems | 25% |
| Exam I | 25% |
| Exam II | 25% |
| <u>Exam III</u> | <u>25%</u> |
| Total | 100% |

Grading and Policies:

A: 90%-100% B: 80%-<90% C: 70%-<80% D: 60%-<70% F: 0-<60%

Late course work will not be accepted.

No make-up work will be given.

Lab Work Evaluation:

| | <u>Value</u> |
|---------------------------------------|--|
| Attendance | 70% |
| Demonstrate Proper Lithography Mask-1 | 10% 1 st try, 5% 2 nd try, 0% no effort |
| Demo Proper Lithography Mask-2 | 10% 1 st try, 5% 2 nd try, 0% no effort |
| <u>Demo Working Devices</u> | <u>10% 1st try, 5% 2nd try, 0% no effort</u> |
| Total | 100% |

Lab Safety Training:

All students will be required to register and complete UTEP's Lab Safety Training before entering the cleanroom. The Lab Safety training will be given during class in the first week. Click on the following link to register for the Lab Training:

<http://ehs.utep.edu/training.html>

Cleanroom Safety and Rules:

All students will be required to attend the Cleanroom Safety and Rules training session before entering the cleanroom. The training session will be given during class in the first week.

Academic Dishonesty:

Incidents of academic dishonesty will be referred to the Director of Electrical Engineering and the Dean of Students. <http://studentaffairs.utep.edu/Default.aspx?alias=studentaffairs.utep.edu/dos>

The descriptions and definitions of academic dishonesty can be found at:

<http://admin.utep.edu/hoop> Look under Student Affairs and then Chapter one, section 1.3.1.

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.