

# ECE 442 Syllabus

<b>Course:</b>	ECE 442
<b>Credit Hours:</b>	3
<b>Course Title:</b>	Introduction to IC technology and fabrication
<b>Course Description:</b>	

Semiconductor device and integrated-circuit processing and technology. Wafer specification and preparation, oxidation, diffusion, ion implantation, photolithography, design rules and measurement techniques.

**Prerequisite(s):** ECE 404 or equivalent

**Textbook(s) and/or other required material:**

Microchip Manufacturing, Stanley Wolf, Lattice Press, 2004 ISBN: 0-9616721-8-8

**Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):**

- 1.Explain silicon oxidation and calculate oxide thicknesses.
- 2.Measure silicon dioxide films on silicon wafers with an interferometer and an ellipsometer.
- 3.Design processes to produce specific oxide pattern on wafers.
- 4.Demonstrate how photolithography is used to pattern silicon wafers.
- 5.Discuss how diffusion and ion implantation are used to introduce impurities into silicon wafers and use models to calculate the impurity profiles.
- 6.Demonstrate alignment of multiple levels on silicon wafers.
- 7.Etch polysilicon with both wet and dry etching to compare/contrast the methods.
- 8.Measure various resistance structures, MOSFETs, MOS Capacitors, inverters, and ring oscillators with a semiconductor parameter analyzer and probe station.

**Topics covered:**

- 1.An Overview of Microelectronic Fabrication, writing lab reports, safety exam (3)
- 2.Thermal oxidation of silicon (2)
- 3.Photolithography (2)
- 4.Diffusion (2)
- 5.Ion implantation (1)
- 6.Etch/Plasma (Supplement) (1)
- 7.Film deposition (1)
- 8.Oxidation - CV measurement (1)
- 9.Resistance Measurements (1)
- 10.MOSFET measurements (1)
- 11.Interconnections and Contacts; Packaging and yield (1)

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**Class/laboratory schedule (sessions per week and duration of each session):**

One 75-minutes lecture per week, one 2hrs. and 50mins laboratory per week.

**Contribution of course to meeting the requirements of Criterion 5 - other:**

**Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:**

Basic Math and science (1 hr)

**Contribution of course to meeting the requirements of Criterion 5 - engineering topics:**

Engineering Science (2 hrs)

**Contribution of course to meeting the requirements of Criterion 5 - general education:**

**Relationship of this course to program learning outcomes:**

<b>Learning Outcome</b>	<b>Level of Instruction</b>	<b>Related Course Content</b>
Outcome A	Major	Students learn how to use oxidation and diffusion models to calculate silicon dioxide thicknesses and impurity profiles. 
Outcome B	Major	Student learn how to measure thin films and relate data to processes.
Outcome C	Major	Students learn how to design process flows to fabricate specific patterns and devices on silicon wafers.
Outcome D	Major	Students work in groups to collect, analyze, and report data measured in the laboratory. Students also work in teams to research and present material on a class-related subject.
Outcome E	Intermediate	Students learn how to evaluate data measured

**Relationship of this course to program learning outcomes:**

<b>Learning Outcome</b>	<b>Level of Instruction</b>	<b>Related Course Content</b>
Outcome F	N/A	in the laboratory. 
Outcome G	Major	Students compose weekly lab reports to describe the completed processing steps. Student present and write a paper about a class-related topic.
Outcome H	N/A	
Outcome I	N/A	
Outcome J	N/A	
Outcome K	Major	Students learn how to use basic semiconductor fabrication and electrical characterization equipment.

**Person who last prepared this description and date of preparation:**

- Yu, Donna G (dgyu) - Mar 31st, 2009 (06:35pm)