ECE 442 Syllabus

Course: ECE 442
Credit Hours: 3
Course Title: Introduction to IC technology and fabrication
Course Description:
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:
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:

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Level of Instruction</th>
<th>Related Course Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome A</td>
<td>Major</td>
<td>Students learn how to use oxidation and diffusion models to calculate silicon dioxide thicknesses and impurity profiles. &lt;BR&gt;</td>
</tr>
<tr>
<td>Outcome B</td>
<td>Major</td>
<td>Student learn how to measure thin films and relate data to processes.</td>
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<tr>
<td>Outcome C</td>
<td>Major</td>
<td>Students learn how to design process flows to fabricate specific patterns and devices on silicon wafers.</td>
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<tr>
<td>Outcome D</td>
<td>Major</td>
<td>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.</td>
</tr>
<tr>
<td>Outcome E</td>
<td>Intermediate</td>
<td>Students learn how to evaluate data measured</td>
</tr>
</tbody>
</table>
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<tr>
<td>Outcome F</td>
<td>N/A</td>
<td>Students compose weekly lab reports to describe the completed processing steps.</td>
</tr>
<tr>
<td>Outcome G</td>
<td>Major</td>
<td>Student present and write a paper about a class-related topic.</td>
</tr>
<tr>
<td>Outcome H</td>
<td>N/A</td>
<td>Students learn how to use basic semiconductor fabrication and electrical characterization equipment.</td>
</tr>
<tr>
<td>Outcome I</td>
<td>N/A</td>
<td></td>
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<tr>
<td>Outcome J</td>
<td>N/A</td>
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<tr>
<td>Outcome K</td>
<td>Major</td>
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**Person who last prepared this description and date of preparation:**

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