ECGR4151 – Solar Cell Fundamentals and Technology

(For electrical and computer engineering students)

Catalog Data Applications in the disciplines of Electrical and Computer Engineering utilizing the tools and techniques specific to the major. Emphasis on analysis skills, mathematical skills, understanding of the profession/curriculum, and problem solving skills.

References ECE: All information is available on web - http://coefs.uncc.edu/jahudak/
Mosaic version of AUTOCAD

Goals By the end of the semester students will have the information and training needed to fabricate a basic silicon solar cell while working in a clean room environment. Students will also learn clean room protocols, hazardous materials handling, and microelectronic fabrication processes. Students will also be able to communicate their final product design in both a slide presentation and written report.

Prerequisite ENGR 1202 for ECE students with a grade of C or better

Class Topics 1. Introduction – solar cell overview
2. Clean Room protocols and hazardous materials handling
3. Clean room safety
4. Electronic materials- silicon
5. Solar cell structure
6. Intro to clean room
7. Wafer cleaning and contamination
8. Doping
9. Conductor deposition techniques
10. Front side conductor deposition
11. Photolithography and schematics
12. Back side deposition
13. I/V Testing
14. Redesign of custom solar cell
15. Cost including cost per watt analysis of fabricated solar cell
16. Presentation skills and using PowerPoint
17. Final Report overview and examples
18. Final exam review

Students are required to submit 2 slide presentations, one after the initial fabrication and one after the modified process fabrication.

Outcomes ECE: Students will learn solar cell fundamentals (photovoltaic) including solar cell design, solar cell fabrication, solar cell testing procedures, and ways to improve performance of solar cells focusing on silicon solar cells. They will learn
to create and fabricate a silicon solar cell using microelectronics fabrication tools and processes. They will also learn microelectronics fabrication methods. Students will be able to effectively present the results both with a slide presentation and with a written report. **ABET G**

**Computer Usage**
Electronic submission of homework assignments is required; also AutoCAD, PowerPoint, Word, and Excel

**Laboratory**
ECE: One-two hours per week will be lectures providing the information necessary to fabricate a solar cell... Students will spend time each week in the microelectronics cleanroom lab fabricating solar cells.

**Design Content**
Students will be provided opportunities to develop proficiency in the engineering design process learned in ENGR 1202.

**Grading**
Attendance, homework, and tests = 40%; final exam = 20%; First Fab PowerPoint = 10%; and Final Fab with modified process PowerPoint = 30%

**Follow-up Courses**
Courses in photovoltaic devices, LEDs, advanced electronic materials, VLSI processing

**Academic Integrity**
Students have the responsibility to know and observe the requirements of the UNCC Code of Student Academic Integrity (2001-2003 UNCC Catalog, p. 275). This code forbids cheating, fabrication or falsification of information, multiple submissions of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty.

**Notes**
All materials submitted for grades (e.g. test and final problems, homework assignments) must represent the student's original work. Students may discuss homework problems, including comparing answers. Copying another student's work, or copying a solutions manual is strictly forbidden. It is the responsibility of every student to know and observe the requirements of the UNCC Code of Student Academic Integrity. This Code forbids cheating, fabrication or falsification of information, multiple submissions of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty. Any student violating the Code will be subject to the penalties described in this document. If in doubt, please ask before you engage in any activity about which you are unsure.

**Instructor**
Mr. John Hudak