# ELEG 4223 - DESIGN AND FABRICATION OF SOLAR CELLS

Spring Semester, 1996

Catalog Data: 1995- 1996
ELEG 4223. Design and Fabrication of Solar Cells. Solar insolation and its spectral distribution; p-n junction solar cells in dark and under illumination; solar cell parameters, efficiency limits and losses; Standard cell technology; energy accounting; design of solar cells using simulation; fabrication of designed devices in the lab and their measurements. Corequisite: 4203 or consent.

Textbook:
Martin A. Green, Solar Cells, The University of New South Wales, 1986.
Solar Cell Fabrication Laboratory Manual, H. A. Naseem and W. D. Brown, Department of Electrical Engineering, University of Arkansas, 3rd edition, 1995.

References:
Modular Series on Solid State Devices, vl. 1 & 2, Neudeck and Pierret.
Solid State Electronics Devices, Ben Streetman.
PC-1D Manual, Sandia National Laboratories, Albuquerque, NM.

Coordinator:
H. A. Naseem, Professor of Electrical Engineering.

Goals:
To learn the basic physics underlying the operation of solar cells.
To learn techniques of designing high efficiency silicon solar cells.
To fabricate and test their devices.

Prerequisites By Topic:

1. Basic Laboratory procedures and safety.
2. Basic chemistry.
3. Basic knowledge of electronic devices and simple circuits.
4. Differential equations.
5. Knowledge of a higher level computer language

Topics:

1. Solar cells and sunlight. ( 1 Class*)
2. Semiconductor properties including interaction of light with semiconductors. (4 classes)
3. p-n junction solar cells. (4 classes)
4. Solar cell parameters. (2 classes)
5. Standard solar cell technology and cost effective new technologies. (3 classes)
6. Design of Si solar cells using hand calculations and computer programming as well as personal computer simulation program PC-1D. (6 classes)

Computer Usage:

Several simulation runs using PC-1D and higher level programming language are used for optimization of device parameters for high efficiency solar cells.

Laboratory:

1. Lab safety, wafer cleaning and oxidation. (1 lab+)
2. Photolithography. (1 lab)
3. Diffusion experiments. (2 labs)
4. Metalization and sintering. (2 labs)
5. Measurements. (1 lab)

Design Project:

The students are to design optimum substrate doping concentration, junction depth and top layer doping for highest one-sun efficiencies using simulation program PC-1D and/or writing a source code in a higher level programming language such as C or Fortran.

ABET category content as estimated by faculty member who prepared this course description:

| | |
|---|---|
| Engineering Science: | 1 credit or 33%. |
| Engineering Design: | 2 credits or 67%. |

* Three 50 minute classes per week.

+ Typically one 4 hour lab per week.

Prepared By:_____ Date:_____