



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF ENGINEERING

# Photovoltaics Laboratory

## ECE 5237

### Credit Hours:

4.00

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### Course Levels:

Undergraduate (1000-5000 level)

Graduate (5000-8000 level)

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### Course Components:

Lecture

Lab

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### Course Description:

Introduction to laboratory techniques for processing and fabrication of inorganic and organic solar cells, and photovoltaic testing and measurement techniques to characterize solar cells.

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### Prerequisites and Co-requisites:

Prereq: 3030 or MatScEn 3271, and enrollment in ECE or MatScEn major; or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.

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### Course Goals / Objectives:

- Introduce the student to the basic techniques for fabrication and measurement of photovoltaic cells
  - Learn computer tools for simulation of photovoltaic cell characteristics
  - Apply knowledge learned in prerequisite semiconductor devices courses to the fabrication and evaluation of PV cells and test structures
  - Obtain practical experience with contact and series resistance, spectral sensitivity, open circuit voltage, short circuit current, and quantum efficiency of photovoltaic devices and test structures by application to the devices fabricated in lab
  - Obtain practical experience with extraction of device parameters from and analysis and interpretation of solar cell measurement and test results
  - Obtain experience with cleanroom procedures, and with safe use of the hazardous materials and equipment used in photovoltaic device fabrication
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**Course Topics:**

- Solar energy and photovoltaic technologies, Lab safety, Overview of class PV processes
  - Inorganic solar cell device physics
  - Ohmic contact technologies for inorganic solar cells
  - Inorganic solar cell design and simulation tools
  - Electrical and optical parasitic losses
  - Photovoltaic measurement techniques
  - Cleanroom orientation, safety protocols and inorganic wafer introduction
  - Inorganic solar cell mesa patterning
  - Mesa etching and oxidation for inorganic solar cell
  - Front side metal patterning of inorganic solar cell
  - Front side metal deposition
  - Backside metallization and anneal
  - Inorganic solar cell testing - illuminated I-V, quantum efficiency, cell performance parameters
  - Organic cell electrode patterning and etching
  - Successive depositions of the organic layer stack followed by metalization
  - Encapsulation
  - Organic solar cell testing - illuminated I-V, quantum efficiency, cell performance parameters
  - Organic semiconductor materials
  - Organic semiconductor materials deposition techniques
  - Organic semiconductor device architectures
  - Optical and electrical properties of organic materials
  - Testing and calibration of organic solar cells
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**Designation:**

Elective