

# ME 516: Thin-Film PV Technology

## ***Course Goals:***

Explore the science and technology of solar energy conversion, with a goal of incorporating cutting-edge trends in the field. Using thin-film PV devices as an example, provide a combination of theoretical and hands-on experiences, giving the student a sense of approaches more generally applicable in contemporary photovoltaic device research.

## ***Topics Covered:***

1. Basics: Review of fundamentals of photovoltaic energy conversion
2. Thin-film solar cell designs
3. Important parameters governing solar cell performance
4. Materials science of thin-film solar cell materials
5. Characterization tools for solar cells and materials
6. Simulation software for modeling solar cell operation
7. Lab techniques for making thin-film solar cells

## ***Grading:***

<u>4-5 Homeworks:</u>	25% (article readings/computer modeling/problems)
<u>Advanced topic presentation:</u>	25% (1 readings/research/presentation)
<u>Device project:</u>	25% (1 lab project/report/presentation)
<u>Midterms:</u>	25%

# Approximate Syllabus...

- Jan 8 Intro to thin-film PV
- Jan 13 Review of solar cells: Semiconductor physics and design
- Jan 15 Review of solar cells: p-n junction in thermal equilibrium; Class review
- Jan 20 No Class (MLK Day)
- Jan 22 Review of solar cells: p-n junction under bias and in light; Class review
- Jan 27 Review of solar cells: p-n junction under bias and in light; Recombination mechanisms
- Jan 29 Recombination mechanisms Loss mechanisms; Limits on Single Junction PV; Tandem
- Feb 3 Recombination/Losses finished
- Feb 5 Characterization approaches
- Feb 10 Types of thin-film PV (CIGS/CdTe/CZTS, DSSC, nanoparticle)
- Feb 12 Review for mid-term
- Feb 17 Midterm #1 (on device physics)
- Feb 19 Detailed look at CdTe TF Technology
- Feb 24 Detailed look at CIGS TF Technology
- Feb 26 Device Modeling and Analysis (AMPS1D and SCAPS)
- Mar 3 CZTS and “earth abundant” technologies
- Mar 5 Amorphous Si and organic PV Detailed look at perovskite PV
- Mar 7 to Mar 16 – Spring Break
- Mar 17 Detailed look at perovskite PV
- Mar 19 Intro to lab; go over fab and characterization approaches
- Mar 24 to Apr 9 -- Schedule lab time to do projects (3 groups)

# Approximate Syllabus...

- Apr 14 Presentation of lab results
- Apr 16 Student presentations
- Apr 21 Student presentations
- Apr 23 Mid-term #2 (on technologies)... Final