

EEE 465/591

Photovoltaic Energy Conversion

Overview: This course will introduce you to the physics and engineering of photovoltaic energy conversion. While the focus will be on photovoltaic devices, we will also cover the basics of radiation, the thermodynamic limits of energy conversion, grid-tied photovoltaic systems, and sustainability and economics. The emphasis of the course will be on conceptual understanding and order-of-magnitude calculations rather than memorization of equations; we will consider the course a success if you can explain to your mother why she should or should not install photovoltaic modules on her roof, what kind of modules she should use, and why they're only 10–20% efficient.

Prerequisites: EEE 352 or an equivalent basic understanding of solid state devices.

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Office hours: M, W 15:30–16:00 (Holman)
T, Th 11:45–12:15 (Honsberg)
Or by appointment

Class hours: T, Th 10:30–11:45; LSE-B04

Textbooks: None required. Optional: Würfel, *Physics of Solar Cells*, Wiley, 2009; Wenham, *Applied Photovoltaics*, Routledge, 2012; Markvart, *Solar Electricity*, Wiley, 1999.

In-class assessment: At the start of each class, you will be asked to answer a basic question pertaining to the previous lecture. The assessment is intended to encourage attendance and review of the previous lecture prior to class.

Homework: There will be occasional reading assigned, and four homework assignments over the course of the semester. The homework will be calculation based. Your lowest-scoring homework assignment or quiz will be dropped.

Quizzes: Four 30-45-minute in-class quizzes administered throughout the semester will replace midterm exams. The quiz questions will be conceptual and will require little, if any, computation. No make-up quizzes will be given, but please talk to the instructors if you anticipate missing a quiz. Your lowest-scoring homework assignment or quiz will be dropped.

Final project: You will turn in a final project in place of taking a final exam. You will in groups of three (these will be assigned), and your team will present your project during the final week of class or during the final exam session. The final project will be to design a stand-alone photovoltaic system, including selecting a location, calculate the operating characteristics of a photovoltaic manual, select a load, and calculate the optimum number of modules, module orientation, battery size, and system voltage; and finally, assess the economics of the system.

Grades:	In-class assessment:	10%
	Homework:	30%
	Quizzes:	30%
	Final project:	30%

Your course grade is determined based on your total score (final average) S as follows:

$S \geq 98$: A⁺; $93 \leq S < 97$: A; $90 \leq S < 93$: A⁻
 $87 \leq S < 90$: B⁺; $83 \leq S < 87$: B; $80 \leq S < 83$: B⁻
 $77 \leq S < 80$: C⁺; $73 \leq S < 77$: C; $70 \leq S < 73$: C⁻
 $60 \leq S < 70$: D; $S < 60$: E

Academic Integrity/Cheating: Students should abide by the Student Academic Integrity Policy and ASU's Student Code of Conduct:

http://www.asu.edu/studentaffairs/studentlife/judicial/academic_integrity.htm.

The highest standards of academic integrity are expected of all students. The failure of any student to meet these standards may result in suspension or expulsion from the university and other sanctions as specified in the academic integrity policies of the individual colleges. Violations of academic integrity include, but are not limited to, cheating, fabrication, tampering, plagiarism, or facilitating such activities.

Under no circumstances will violations of academic integrity be tolerated. Penalties include reduced or no credit for submitted work, a failing grade in the class, a note on your official transcript that shows you were punished for cheating, suspension, expulsion, and revocation of already awarded degrees. If you are not sure if something is allowed or not allowed, you should ask the course instructor. The university requires that, should the instructor implement any penalty for violation of the academic integrity policy, the instructor report the matter to the Dean's office.

Course Outline:

- Why solar?
- Solar radiation
- Efficiency limits of photovoltaic (PV) devices
- Semiconductors and junctions
- PV device operation and performance
- PV cell technologies: silicon, thin-film, concentrating PV
- PV modules
- PV systems, grid integration, and economics