



Faculty of Health, Science and Technology
Physics

Syllabus

Physics of Solar Cells

Course Code:	FYAD14
Course Title:	Physics of Solar Cells <i>Solcellsfysik</i>
Credits:	7.5
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has only first-cycle course/s as entry requirements (A1N)

Major Field of Study:

FYA (Physics)

TKA (Engineering Physics)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2024-01-30, and is valid from the Spring semester 2024 at Karlstad University.

Prerequisites

A Bachelor degree in Engineering, a Master degree in Engineering, or a Bachelor degree with a main field of study in Electrical Engineering, Mechanical Engineering, Energy Engineering, Physics, or Engineering Physics, or 90 ECTS credits in Physics and 15 ECTS credits in Mathematics, plus upper secondary level English 6, or equivalent

Learning Outcomes

Upon completion of the course, students should be able to:

- apply the theoretical foundations of semiconductor physics to explain the functioning of solar cells and calculate relevant quantities,
- give an account of important concepts in solar cell physics, such as passivation and recombination,
- give an account of different production technologies used for silicon wafers and solar cells,

- give an account of the structure, function, and production of solar modules,
- give an account of the most important methods used to characterise solar cells and modules, and
- apply techniques to identify the causes of problems in solar cells and modules based on provided measurement data.

Content

In the course, students will acquire knowledge about the physics and function of solar cells, as well as various types of solar cells, including potential future concepts.

The course covers the following:

- Semiconductor physics of the PN junction
- The structure and function of current silicon-based solar cells and modules
- Production technologies for silicon wafers and manufacturing methods for solar cells and modules
- Processes that limit efficiency and concepts for efficiency enhancement
- The structure and function of other types of solar cells and future concepts
- The main characterisation methods for solar cells
- Degradation of solar cells and modules
- Module testing standards
- Solar radiation
- Simulation of solar cells

Reading List

See separate document.

Examination

Assessment is based on oral presentations, a written exam, and hand-in assignments.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional information

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.