

# Solar Cell Technology

Programme course

6 credits

Solcellsteknik

TNE093

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

## Main field of study

Electrical Engineering

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Electronics Design Engineering, M Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Semiconductor devices or equivalent

## Intended learning outcomes

The purpose of this course is to give the student wide and in some parts deep knowledge of how solar cells work, designed and manufactured. What percentage of the solar energy is converted into electrical current and the properties of the solar cell and the sunlight that affect this. How to measure different solar cell's parameters and how to design a solar electricity system. After this course students should be able to:

- describe how solar cells work, designed and manufactured.
- calculate the solar cell's parameters such as fill factor, open circuit voltage, load current, output at maximum power point.
- calculate the intensity of sunlight at Earth's surface under different conditions.
- calculate the yield at different temperatures and light conditions.
- to design a photovoltaic system for different applications and power needs.
- describe different concepts such as partial shading, quantum efficiency, direct, diffuse and global lighting, effect of atmosphere on solar power, the influence of temperature on solar power and voltage.
- describe the functions of charge controllers and inverters.
- describe batteries characteristics and factors affecting the capacity and lifetime.

## Course content

- Sunlight properties: radiation and insolation, atmospheric, time and place effects
- repetition of the pn junction
- solar cell function. ideal solar cell, quantum efficiency, spectral response, solar cell parameters such as IV curve, open circuit voltage, short circuit current, fill factor, efficiency
- Resistive effects: series and shunt resistances
- Temperature and light intensity influence
- Design in order to reduce reflection losses, recombination losses, shading effect.
- Manufacture of Solar Cells: texturing front, anti-reflective coating, front side contact, backside contact.
- Manufacturing of solar panels
- Design and other system components, charge controllers, batteries, converters, cables

## Teaching and working methods

Lectures, laboratory work and projects

## Examination

LAB1	Laboratory work	1 credits	U, G
UPG1	Written and oral presentation	1 credits	U, G
TEN1	Written examination	4 credits	U, 3, 4, 5

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Department

Institutionen för teknik och naturvetenskap

## Director of Studies or equivalent

Adriana Serban

## Examiner

Amir Baranzahi

## Course website and other links

<http://www2.itn.liu.se/utbildning/kurs/index.html?coursecode=TNE093>

## Education components

Preliminary scheduled hours: 44 h

Recommended self-study hours: 116 h

## Course literature

Kompendium: Solcellsteknik författat av Amir Baranzahi (svenska), handouts på engeska samt engelskspråkiga deltagare hänvisas till relevanta webbsidor.

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).