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 i 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://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.