Course syllabus

Solel - grundkurs i solcellsteknik Photovoltaic Systems, Basic Course

AEBF30, 7,5 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED V
Date of Decision: 2023-03-21

General Information

Compulsory for: MHET1
Elective for: E4-em, F4, F4-es, M4, W4-es
Language of instruction: The course will be given in English

Aim

There is from a national and global point of view necessary to develope renewable energy technologies for generating electric energy. PV-system will in the future be one of the most important technologies for producing electricity. The course aims at teaching basic knowledge of how solar cells and solar cell systems works in different applications. In Sweden building integrated PV-systems are most interesting. In the developing countries where many people lives outside the electric grid, stand alone PV systems are of great interest. The ability to simulate the performance of PV-systems is an important part of the course. After the course the student should be able to perform a prestudy of the installation of a new PV-system

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to describe the national and international use and demand of energy and the importance of the renewable energy sources.
- understand and be able to describe how different types of solar cells work
- understand and be able to describe how grid connected and stand alone PV-systems can be used for generating and conserve electricity.

- understand and be able to describe the advantages and limitations of PV-systems
- understand and be able to describe how the PV system interact with the electricity system

Competences and skills
For a passing grade the student must

- be able to estimate and describe the use of energy in a building
- be able to charcterize a PV-module, i.e. measure the IV-curve
- be able to use a simulation programme for estimation of the energy delivered from a PV-system
- be able to construct a stand alone or a grid connected PV system and describe how its components work
- be able to use a simulation programme for estimation of the solar irradiance towards surfaces in different geometries.
- be able to with different methods calculate the cost for PV-electricity and competing technologies

Judgement and approach
For a passing grade the student must

- be able to take part in and analyze the current discussion of energy use and global environmental problems
- be aware of the influence of the building design and the energy system on the energy use of the building
- be able to perform a critical analysis of the use and value of delivered solar energy
- learn to critically evaluate and analyse information in general

Contents

- basic energy knowledge and the problems connected to the use of energy
- radiation physics, the annual irradiance distribution and the climatic conditions for using solar energy in Sweden, calculation of solar angulars and the irradiance on different surfaces
- the PN-junction and Solar cell physics. The construction and function of a PV-module.
- function and performance of the components in the PV-system; batteries, power point tracker, DC-AC inverter, charge regulator.
- system design of stand alone and gridconnected systems
- building integration of PV-system
- use of simulation programmes
- laborations and computer simulations
- studievisits to PV installations

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written or oral examination, approved assignments, approved reports from laborations and attendence at study tour.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0121. **Name:** Examination.
Credits: 4,5. **Grading scale:** TH. **Assessment:** Written **Contents:** Examination
Code: 0221. **Name:** Laboratory.

Credits: 1. **Grading scale:** TH. **Assessment:** Report **Contents:** Laboratory work **Further information:** Group work

Code: 0321. **Name:** Deep Assignment.
Credits: 2. **Grading scale:** TH. **Assessment:** Report and presentation **Contents:** Deep assignment **Further information:** Group work

Admission

Assumed prior knowledge: Basic courses in electricity and electronics. Experience from the use of calculation program like Matlab and Excel.
The number of participants is limited to: 60
Selection: Completed university credits within the programme. Priority is given to students enrolled on programmes that include the course in their curriculum. Priority given for students at MHET - Master's Programme in Sustainable Energy Engineering - as this is a mandotory course.
The course overlaps following course/s: TNV095

Reading list

- Stuart R. Wenham, Martin A. Green, Muriel E. Watt and Richard Corkish: Applied Photovoltaics. Earthscan, 2007, ISBN: 9781844074013.
- Written course material which is developed within the course.
- Simulation program System Advisor Model and calculation program for solar angles (Excel).

Contact and other information

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