DALARNA UNIVERSITY

Programme Syllabus

Master Programme in Solar Energy Engineering 60 Credits*

Magisterprogram i solenergiteknik 60 högskolepoäng

1. Objectives of the Educational Programme

1.1 Objectives, as Specified in the Higher Education Act (1992:1434), Chapter 1, section 9:
Second-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students during first-cycle courses and study programmes, or its equivalent.

Second-cycle courses and study programmes shall involve the acquisition of specialist knowledge, competence and skills in relation to first-cycle courses and study programmes, and in addition to the requirements for first-cycle courses and study programmes shall:

- further develop the ability of students to integrate and make autonomous use of their knowledge
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable autonomy, or for research and development work

1.2 Degree Objectives, as Specified in the Higher Education Ordinance (1993:100), appendix 2:
Knowledge and understanding
For the degree of Master the student must

- demonstrate knowledge and understanding in the main subject area, including both an overview of the area and deeper knowledge of certain parts of the area as well as insight into current research and development in the area, and
- demonstrate advanced methodological awareness in the main subject area of the programme.

Skills and ability
For the degree of Master the student must

* 1 Credit = 1 ECTS

- demonstrate an ability to integrate knowledge and to analyse, judge and handle complex phenomena, issues and situations even with limited information,
- demonstrate an ability to independently identify and formulate issues and to plan and carry out, using suitable methods, demanding tasks within the given timeframe,
- demonstrate an ability to, both orally and in writing, present and discuss conclusions and the knowledge and arguments on which these are based in dialogue with different groups, and
- demonstrate the skill required to take part in research and development work or to work in other demanding activities.

Critical skills and approach
For the degree of Master the student must

- within the main subject area demonstrate an ability to make judgements with reference to relevant scientific, social and ethical criteria and demonstrate awareness of ethical aspects of research and development work,
- demonstrate insight into the possibilities and limitations of science and its role in society and the responsibility of individuals in how it is used, and
- demonstrate the ability to identify his or her own need of further knowledge and to take responsibility for the development of his or her own knowledge.

1.3 Objectives of the Programme

After completing the programme, the student will be able to:

Knowledge and Understanding

- show in-depth understanding of various solar energy technologies in terms of their physical processes and mathematical models for energy output in converting solar radiation into electrical or thermal energy
- show detailed knowledge regarding the components of importance in solar energy systems and how their function depends on solar radiation and other climatic factors
- show detailed knowledge of how heating, cooling, ventilation and daylight needs in both buildings and communities are affected by solar radiation and other climatic factors

Competence and Skills

- demonstrate the ability – using a scientific approach – to theoretically and experimentally analyse both individual components and whole solar energy

systems, as well as their functions and interrelations
- demonstrate the ability to design efficient solar energy systems from technical components, climate and energy demands, and other relevant conditions
- demonstrate the ability to use different types of advanced software to model, design and optimize different types of solar energy systems
- demonstrate the ability to measure, process and analyse relevant data for solar energy applications, and evaluate the reliability in the obtained results
- demonstrate the ability to derive the investment, operating and life-cycle costs of solar energy systems

Judgement and Approach

- critically evaluate existing facilities for both solar electricity and solar thermal, and propose measures to improve performance or correct deficiencies
- demonstrate the ability to evaluate the technical, social, economic and ethical barriers and drivers for the implementation of solar energy technologies in different types of communities
- evaluate how solar solutions can contribute towards the transition towards a sustainable society from a social, economic and environmental and climatatic perspective
- demonstrate the ability, from an engineering science perspective, to independently evaluate the role that various solar energy technologies can play in the energy supply of heating systems and electrical systems, as well as in the energy balance in buildings.

2. Main Structure of the Programme

The programme is a master programme, 60 cr, within the main discipline of Solar Energy Engineering. All courses are given in English.
This master programme aims to prepare students to work in the solar energy industry and/or to participate in research in the areas of solar thermal technologies and systems, and solar electricity technology and systems.

The programme starts with courses on solar energy technology and systems, on solar radiation, passive use of solar energy in buildings and applied economics. The courses are identical with the courses in the two-year Master Programme in Solar Energy Engineering.

The majority of courses in the first semester impart theoretical knowledge of solar energy technology, such as the technical basics of components and subsystems for the use of solar energy in the production of heating, cooling and electricity and how it can be used directly in buildings. In the project course, this theoretical knowledge will be applied to design, build and test a real solar energy component such as a solar collector. The project

course also contains components to prepare students for the thesis work on, for example, scientific writing and measurements analysis.

The second semester starts with two courses where solar thermal and photovoltaic systems solutions for different applications and different local and techno-economical boundary conditions are studied in depth. Profound knowledge from the courses in the first semester is necessary for students to progress through the courses in the second semester.

The programme concludes with the writing of a thesis. The thesis work can be carried out at a university / college, or, by approval, at a business or other organization in Sweden or abroad.

3. Courses of the Programme

First semester
Solar Radiation and Solar Geometry, 5 credits
Solar Thermal, 7.5 credits
Economics and Financing of Solar Energy, 2.5 credits
Photovoltaics, 7.5 credits
Applied Solar Engineering 7.5 credits

Second semester
Solar Thermal Design, 7.5 credits
PV and Hybrid Systems Design, 7.5 credits
Degree Thesis in Solar Energy Engineering, 15 credits

4. Degree Awarded

Degree of Master of Science (60 credits), Main Field of Study: Solar Energy Engineering (Teknologie magisterexamen, huvudområde: Solenergiteknik).

5. Required Entry Qualifications

Bachelor of Science degree in engineering (mechanical, electrical, energy, engineering physics) of at least 180 credits and English 6

6. Other Information

The bachelor degree should preferably include a bachelor thesis. This criterion together with possible confirmed work experience, will be used in the selection process of candidates in case the number of applicants exceeds the number of available places.

Approved:

Approved by the University Faculty Board 7 October 2015
Valid from Autumn semester 2016

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Revised:
Revised, 30 May 2023
Revision is valid from Spring semester 2023