DALARNA UNIVERSITY

Programme Syllabus

Master Programme in Energy Efficient Built Environment 60 Credits*

Magisterprogram i Energieffektivt byggande 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

* 1 Credit = 1 ECTS

For the degree of Master the student must

- 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

- demonstrate a basic understanding of how geographical location, adjacent environment and climate influences the solar and other renewable energy potential of premises,
- demonstrate a broad knowledge of low-energy building design strategies: their focus, their approach and main characteristics (i.e. advantages, disadvantages, applicability and limitations),
- demonstrate an in-depth knowledge of various energy efficiency measures and the ability to select the right ones for specific situations while taking into considerations material properties, building structures and technologies, economic and environmental costs, as well as personal or societal preferences,

- demonstrate a working knowledge of various sustainability certification schemes and energy efficiency assessment tools,
- demonstrate a critical understanding of how the technological, economic and social contexts—such as the available or dominant energy system, the existing urban infrastructure, the local building tradition, the development rules and regulations, and the individual or social attitudes—influence energy conservation targets, approaches and outcomes.

Competence and skills

- integrate knowledge encompassing various physical scales and disciplines that influence the energy efficiency of the built environment, as well as to critically assess specific problems and situations,
- demonstrate the ability to identify problems, and to design and implement a plan—using suitable methods—to remedy the situation within a given timeframe,
- demonstrate the ability to deliver energy efficiency concepts and proposals during the design or retrofitting process of a building and to present the knowledge and the rationale behind the proposal to fellow professionals, to the public and to various other stakeholders,
- demonstrate advanced skills required for both participating in research and development and executing qualified independent work aiming to improve the energy efficiency of the built environment.

Judgment and approach

- demonstrate the ability to critically evaluate design proposals and existing buildings, and to propose informed solutions for improving their thermal and environmental performance in a way that is both socially and environmentally sustainable and is also ethically legitimate,
- demonstrate a broad knowledge of the technical, social, economic and ethical drivers and barriers to achieving energy efficiency in the built environment,
- demonstrate the ability to identify personal needs for supplemental knowledge and to take responsibility for the development of his or her own knowledge.

2. Main Structure of the Programme

The programme is a one-year master programme (60 credits) offered with the field of energy technology. It is comprised of nine advanced-level courses and one degree project, all thought in English. The courses are offered in the field of energy technology (30.0 cr), building technology (22.5 credits) and civil engineering (7,5 cr).

The goal of the program is to prepare students for the work in the interdisciplinary field of

building technology, energy technology and civil engineering and/or for the participation in associated fields of research.

During the first quarter of the program, students are introduced to the basic components of building energy engineering: the building envelope and its constituent parts (*Energy efficient building design*), and the influence of climate (*Climate-responsive design studio*) and the movement of the sun (*Solar radiation and solar geometry*).

The second quarter focuses on the whole building assessment utilizing the simulation tool IDA ICE and a project that spans across three classes. Through evaluating the impact of different materials and various energy conservation measures (*Building energy performance simulation and analysis*), building forms (*Solar building design*), HVAC systems (*Low-energy HVAC systems*) and their impact on the comfort of inhabitants, courses address all aspects of energy-efficient building design and retrofitting. The independent research, the scientific writing and the project design—that are part of the overarching project of this quarter—serve to prepare students for the final thesis work.

The third quarter broadens the perspective of the students by introducing the wider context of building energy efficiency and assessing the environmental, economic and social impacts of energy-efficient built environments (*Energy and urban planning; Life cycle assessment and cost analy*sis). Students are given the opportunity to learn how the achievable energy and environmental efficiency of a building is the function of its physical and social environment and how the different aspects are interrelated. This quarter will also equip students with various environmental and sustainability assessment methods (*Life cycle assessment and cost analysis; Sustainable building rating systems*).

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

3. Courses of the Programme

All courses are advanced level courses from the field of energy technology, building technology and civil engineering.

First semester

Energy efficient building design, 7.5 credits
Solar radiation and solar geometry, 5.0 credits (energy technology)
Climate-responsive design studio, 2.5 credits
Building energy performance simulation and analysis, 7.5 credits
Solar building design, 5.0 credits (energy technology)
Low-energy HVAC systems, 2.5 credits

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Second semester
Energy and urban planning, 7.5 credits
Life cycle assessment and cost analysis, 5.0 credits (energy technology)
Sustainable building rating systems, 2.5 credits
Degree thesis in energy efficient built environment, 15 credits (energy technology)

4. Degree Awarded
Degree of Master of Science (60 credits), Main Field of Study: Energy Technology
(Teknologie masterexamen, huvudområde: Energiteknik).

5. Required Entry Qualifications
Bachelor of Science degree from building-, energy technology or civil engineering related fields of at least 180 credits and English 6

6. Other Information
Teaching language English.

Approved:
Approved by the Faculty Board Science and Technology 2 December 2016
Valid from Autumn semester 2016