



Faculty of Technology and Science

### **PROGRAMME STUDY PLAN**

<b>Programme Code</b>	TAMEM
<b>Programme Approval</b>	The Programme Study Plan was approved by the Faculty Board of Technology and Science on 13 September 2007 and is valid from the autumn semester of 2007 at Karlstad University.
<b>Programme Title</b>	Master of Science in Engineering, Degree Programme in Environmental and Energy Engineering
<b>Credits</b>	120 ECTS
<b>Language of Instruction</b>	Swedish
<b>Degree Level</b>	Master
<b>Degree Type</b>	Professional degree

**Prerequisites**

A Bachelor's degree of 180 ECTS cr. in Environmental and Energy Engineering, or equivalent, including the following:

- Mathematics 22,5 ECTS cr. covering basic one and multivariable calculus, introduction to vector analysis, and linear algebra.
- Basic science 20 ECTS cr. including mechanics and thermodynamics.
- Basic Environmental and Energy Systems and Mechanical Engineering 90 ECTS cr., including heat and fluid mechanics 15 ECTS cr. and environmental engineering 15 ECTS cr.
- Course/s relevant to engineering 5 ECTS cr. in the humanities, social sciences or gender studies.

**General Information**

The Master's degree programme in Energy and Environmental engineering develops student knowledge in this area and their abilities to contribute to effective and sustainable environment-friendly energy solutions. Students are also prepared for doctoral studies.

**Aims**

Upon completion of the programme students should, beyond the general requirements for a Master's degree specified in the *Higher Education Ordinance, SFS 2006:1053*, be able to:

- demonstrate in-depth knowledge of environment and energy systems, especially modelling and heat and mass transfer optimisation,
- demonstrate ability and experience of active participation in industrial research and development projects,
- work in a group and with others
- formulate, deal with and solve engineering tasks with a multidisciplinary perspective,
- contribute to a sustainable development.

**Programme Structure**

The programme runs over four terms. In the last term the degree project is carried out. The programme is designed to provide opportunities for the students to develop their ability to formulate and solve problems independently and professionally. Many of the courses are connected to current research projects, usually in conjunction with industry. Courses listed below are mandatory, but in order to avoid possible overlapping, students can replace an overlapping course with another at the approval of the Director of Studies.

## **Programme Curriculum**

### **Term 1**

Mathematics, 15 ECTS cr.

Focus: Function of variables, vector functions and curves, partial derivatives, gradients, extreme value problem, equations, interpolation, numerical derivatives, and integration of ordinary and partial differential equations. Computer-aided problem-solving is sometimes practised.

Electives, 15 ECTS cr.

### **Term 2**

Measurement and Modelling, 15 ECTS cr.

The first part of the course deals with different methods for use in the analysis of environmental and energy systems. The methods include, for instance, statistical analysis and modelling, FFT-analysis, different transformers and black-box system identification. Based on the analysis, continuous and discrete dynamic models of the environmental and energy systems studied are created. MATLAB is used as an analytical tool. The second part of the course involves projects, the planning and performing of environmental measurement with modelling in the field and in the laboratory.

Optimization of Environmental and Energy Systems, 15 ECTS cr.

The course focuses on different methods for optimizing energy systems in particular, for instance, district heating, in other words, a systematic way of looking for the optimal solution in certain circumstances and with a certain goal. It could involve designing a cost-effective and environment-friendly system. Methods include the use of linear programming for combined energy and environment optimisation and different methods of optimizing the effectiveness of energy systems, for instance, based on minimizing energy loss or entropy production. The course deals especially with the use of the concept exergy in energy system optimisation.

### **Term 3**

Heat and Mass Transfer, 15 ECTS cr.

The first part of the course deals with the physical correlations of mass and heat transfer. Students start with experimental studies using computer simulation models to develop their understanding of the connection between mass and heat transfer. The second part of the course deals with methods to effectivize energy and environment systems or their apparatuses. Special attention is paid to the way experimental measuring can be combined with computer-aided simulation models.

Research and Development Project, 15 ECTS cr.

Students are expected to develop their abilities and skills in formulating a research question and choose methods to solve a problem in the field of Environmental and Energy Engineering. The course also aims at providing insight into the role of the engineer, and opportunity for the students to transform theory into practice with a view to developing sustainable and technologically efficient components or systems. The

projects are linked to current research projects. Students are required and encouraged to work independently.

**Term 4**

Degree project, 30 ECTS cr.

**Degree Title**

Master of Science Major Environmental and Energy Systems

Students who meet the requirements for a degree may request a degree certificate to be issued by the university. Requests should be submitted to the Office for Student Services.

**Credit Transfer**

According to the *Higher Education Ordinance* (Ch 6, § 12-14), students may transfer credits from previously completed university courses subject to approval. Transfer of credits for a course module, or university studies generally, is subject to the approval by the course examiner. Transfer of credits for a full course is subject to the approval by the Rector

**Additional Information**

Students who enrolled in the programme before 1 July 2007 will complete their studies in accordance with the requirements of the earlier curriculum. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

**Moving Up**

In order to move up to the next level, students on the programme must have completed 45 ECTS cr. in the previous year. Students are not allowed to start working on their Degree projects until they have completed 60 ECTS cr.

The local regulations for undergraduate studies at Karlstad University stipulate the obligations and rights of students and staff.