



Faculty of Health, Science and Technology

Programme Study Plan

Master of Science in Mechanical Engineering

Programme Code: TACMA

Programme Title: Master of Science in Mechanical Engineering
Civilingenjör Maskinteknik

ECTS Credits: 300 ECTS credits

Approval: The Programme Study Plan was approved by the Faculty Board of Health, Science and Technology on 9 December 2016 and is valid from the autumn semester of 2017 at Karlstad University, Rev. 1 Dec. 2022.

Language of Instruction: Swedish and English

Degree Level: Master's

Degree Type: Professional

Prerequisites General admission requirements and Physics 2, Chemistry 1, Mathematics 4/Mathematics E

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Introduction

The programme prepares students to work as engineers in the area of mechanical engineering with specialisation in materials engineering.

Development of engineering excellence and collaboration skills are central in the programme. Graduates from Karlstad University's mechanical engineering programme are able to plan, develop, design, produce and use advanced technological systems.

The programme leads to insight into the role played by engineers in economic and social aspects of societal development, and prepares students to do responsible work. The programme provides knowledge and skills that are nationally in demand and internationally competitive.

The programme further provides a solid theoretical and practical basic knowledge of natural sciences, technology and mathematics and develops personal traits and approaches.

Aims

Karlstad University's Master of Science in Mechanical Engineering programme offers students a broad base in engineering activities, including design, production, and materials used for manufacturing, application and development of mechanical products and processes.

Upon completion of the programme, graduate engineers are prepared for PhD-level study in the field, have the ability to keep up with technological developments and have acquired a basis for lifelong learning.

For a Master of Science in Engineering, students at Karlstad University should meet the requirements specified in the Higher Education Ordinance (SFS 2006:1053) as follows:

- Overarching aim: For a Master of Science in Engineering students should demonstrate the knowledge and skills required to work independently as a graduate engineer.
- Knowledge and understanding

For a Master of Science in Engineering students should

- demonstrate knowledge of the disciplinary foundation of and proven experience in their chosen field as well as insight into current research and development work, and
- demonstrate both broad knowledge of their chosen field, including knowledge of mathematics and the natural sciences, as well as a considerable degree of specialised knowledge in certain areas of the field.

- Competence and skills

For a Master of Science in Engineering students should

- demonstrate the ability to identify, formulate and deal with complex issues independently, critically, creatively and with a holistic approach and also to participate in research and development work and so contribute to the development of knowledge,
- demonstrate the ability to create, analyse and critically evaluate various technological solutions,
- demonstrate the ability to plan and use appropriate methods to undertake advanced tasks within predetermined parameters,
- demonstrate the ability to integrate knowledge critically and systematically as well as the ability to model, simulate, predict and evaluate sequences of events even with limited information,
- demonstrate the ability to develop and design products, processes and systems while taking into account the circumstances and needs of individuals and the targets for economically, socially and ecologically sustainable development set by the community,
- demonstrate the capacity for teamwork and collaboration with various constellations, and
- demonstrate the ability to clearly present their conclusions and the knowledge and arguments on which they are based in speech and writing to different audiences in both national and international contexts.

- Judgement and approach

For a Master of Science in Engineering students should

- demonstrate the ability to make assessments informed by relevant disciplinary, social and ethical aspects as well as awareness of ethical aspects of research and development work,
- demonstrate insight into the possibilities and limitations of technology, its role in society and the responsibility of the individual for how it is used, including both

social and economic aspects and also environmental and occupational health and safety considerations, and

- demonstrate the ability to identify a need for further knowledge and undertake ongoing development of their skills.

- Independent project (degree project)

For a Master of Science in Engineering students should

- as part of the programme complete an independent project (degree project) of at least 30 ECTS credits.

In addition to the requirements specified in the Higher Education Ordinance (SFS 2006:1053) and in Karlstad University's regulations, students completing a Master of Science in Mechanical Engineering should also demonstrate ability to:

- Knowledge and understanding
 - participate in the application and development of new technology for the design of products and processes,
 - give an account of basic knowledge of design, manufacturing, and materials engineering,
 - provide a holistic description of the design process and the relation between materials engineering, engineering design and manufacturing, while taking a sustainable, environmentally-friendly approach, and
 - give an account of specialised knowledge of materials engineering based on materials science, describing the relation between the manufacture, microstructure, application and resulting characteristics of materials.
- Competence and skills
 - apply basic principles of mechanical engineering, follow and draw on knowledge development in engineering,
 - practise a creative and critical working method to formulate and research problems using modern methods and tools of mechanical engineering,
 - apply theoretical knowledge and experimental skills in analysis, simulation and modelling of design, production and materials use.
 - take an industrially environmentally-friendly and sustainable approach to material selection, development and recycling, and
 - participate actively in industrially-affiliated research and development work.
- Judgement and approach
 - take a perspective contributing to sustainable development, e.g. as regards material and processes selection in the field of mechanical engineering.

Programme Structure

The programme is divided into two levels: **Bachelor's level** (180 ECTS cr.) and **Master's level** (120 ECTS cr.).

The **Bachelor's level** comprises six semesters and includes courses in mathematics, natural sciences, the foundations of mechanical engineering in materials engineering, design, calculation, manufacture and production, electrical engineering, energy engineering as well as basic business administration. Students also develop skills in project work, report writing and communication. These courses prepare students for Master-level studies, while they have the opportunity to earn a Bachelor's degree in mechanical engineering.

The **Master's level** comprises four semesters of specialisation in materials engineering taking a holistic mechanical engineering approach that includes design, manufacture and production. Courses provide a broad knowledge base of engineering materials, training in methods for advanced materials characterisation, strength calculations and material modelling. Some of the

course components take the form of projects done by student groups. The final degree project comprises 30 ECTS credits.

All students admitted to the programme are guaranteed places on the Master's level, provided that they meet the entry requirements for Master-level courses.

The programme includes blocks of elective courses. Students should ensure that they have the necessary information about these and should consult programme coordinators when choosing courses, since choices can affect subsequent courses.

Gradual specialisation in the programme is ensured through the formulation of increasingly more complex learning outcomes that are assessed across the programme. Different forms of instruction, working methods and examination formats are used in the programme, ensuring scientific, methodological, content, language and professional specialisation and development. Establishing a strong connection with current research is particularly important for scientific and methodological specialisation.

The university's constant quality enhancement depends on enthusiastic lecturers offering quality courses. Student evaluations, contact with alumni, and student representation in preparatory and decision-making bodies play an important role in this respect. Societal relevance is maintained through partnerships with the community and through including external representatives in preparatory and decision-making faculty bodies.

Contact with the community is established early on in the programme and maintained throughout, with the aim of familiarising students with possible future employment areas and conditions and for cooperation in courses.

Internationalisation

Karlstad University wants to promote cooperation and exchange with other universities. Karlstad University collaborates with many other universities in Sweden and abroad, and encourages students to make the most of such opportunities. Programme students who want to complete some of their courses at foreign institutions, including their degree projects, are therefore supported.

Programme Curriculum

Bachelor's level: Mechanical engineering, including mechanics, solid mechanics, design, manufacturing technology and production systems (105 ECTS cr. of which 15 ECTS cr. comprise elective courses); mathematics (37.5 ECTS cr.), natural science and engineering (30 ECTS cr.) and business administration (7.5 ECTS cr.).

Master's level: Numerical methods (7.5 ECTS cr.) and mechanical engineering, including sustainable product development and specialised courses in materials engineering, simulation and modelling (112.5 ECTS cr. of which 15 ECTS cr. comprise elective courses) and a degree project of 30 ECTS cr.

The extent of most courses is 7.5 ECTS cr., with some exceptions.

Degree Title

Master of Science in Mechanical Engineering

Civilingenjörsexamen Maskinteknik

Credit Transfer

Students have the right to transfer credits from previously completed university courses in Sweden or abroad, subject to approval according to the current regulations.

Additional Information

The local regulations for first and second cycle education at Karlstad University stipulate the obligations and rights of students and staff.