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Faculty of Health, Science and Technology

## Programme Study Plan

### Master of Science in Engineering Physics

<b>Programme Code:</b>	TACTF
<b>Programme Title:</b>	Master of Science in Engineering Physics Civilingenjör Teknisk fysik
<b>ECTS Credits:</b>	300 ECTS credits
<b>Approval:</b>	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.
<b>Language of Instruction:</b>	Swedish and English
<b>Degree Level:</b>	Master's
<b>Degree Type:</b>	Professional
<b>Prerequisites</b>	General admission requirements plus upper secondary school level Mathematics E, Physics B, and Chemistry A, or general admission requirement plus upper secondary school level Mathematics 4, Physics 2, and Chemistry 1  Field-specific eligibility 9 or A9.

#### Introduction

The programme leads to a Master of Science in Engineering Physics. Graduates from the Engineering Physics programme have a broad skills base and their knowledge of basic and applied physics can be used in many areas of engineering. Due to their specialised theoretical understanding of physical phenomena graduates can participate in the development of new technological applications, for example in the area of nanotechnology, in which the structures of matter are used to develop new applications for example in molecular electronics, different types of solar cells, and nano-electromechanical systems.

Students' development of engineering excellence and the ability to cooperate with others are at the core of the programme. Graduates from Karlstad University's Engineering Physics

programme may find employment in the planning, development, design, production and use of systems relying on advanced technology.

The programme leads to insight into the role played by engineers in economic and social aspects of societal development, and prepares students do responsible work. The programme provides knowledge and skills that are nationally in demand and internationally competitive, as well as a good foundation in natural sciences, technology and mathematics, and also develops students' personal traits and approaches.

### **Aims**

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 graduate engineers.
- 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 Engineering Physics should also:

- Knowledge and understanding
  - demonstrate specialised knowledge of the laws of physics and their use in engineering for the development of technological applications, particularly in the areas of materials science and nanoscience.
- Competence and skills
  - demonstrate experience of and ability to participate actively in research and development work, connected to the industry or another organisation,
  - demonstrate ability to retrieve and evaluate current scientific results in engineering physics, particularly taking the form of articles published in international journals, and
  - draw on theoretical knowledge and experimental skills in analysing, simulating and modelling technological applications, particularly in the areas of materials science and nanoscience.
- Judgement and approach
  - take a perspective contributing to sustainable development, e.g. as regards material and process selection in the field of engineering physics.

### **Programme Structure**

The programme is divided into two levels: **Bachelor's level** (180 ECTS cr.) and **Master's level** (120 ECTS cr.). Many of the first two semesters' courses are compulsory for students on different engineering programmes and focus on mathematics, basic natural science and engineering. Offering joint courses for different engineering specialisations has the advantage of promoting understanding of and insight into different aspects of the wide spectrum of engineering. Students are also able to change specialisation, especially during the first year (provided that places are available).

The programme includes blocks of elective and/or optional courses. Students should ensure that they have the necessary information about these and should consult the study counsellor/programme coordinators when choosing courses, since choices can affect subsequent courses and the nature of the degree obtained.

The **Bachelor's level** comprises six semesters and includes courses in mathematics, natural sciences and engineering, as well as an introduction to areas of the humanities and social sciences. Students also develop skills in project work, report writing and communication. These courses prepare students for Master-level studies, but may also lead to a Bachelor's degree in engineering.

The **Master's level** comprises four semesters, including at least 60 ECTS credits of specialisation in the main field of study chosen. A degree project of 30 ECTS credits is included.

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.

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.

### **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, preferably a semester on Master's level and including their degree projects, are therefore supported.

### **Programme Curriculum**

**Bachelor's level:** An introductory course in mathematics (7.5 ECTS credits) is followed by 45 ECTS credits of compulsory courses following a logical progression and including single variable analysis, multiple variable analysis, stochastic methods, complex transforms and numerical methods. Physics include introductory courses in experimental problem solving and mechanics and is followed by quantum physics, thermodynamics, solid state physics, nanoscience, etc. (a total of 97.5 ECTS cr.).

Engineering courses are offered in, for example, programming, materials engineering and project management.

**Master's level:** Compulsory specialisation courses in physics and material physics/engineering are offered, including in mathematical physics, quantum physics and nanophysics (a total of 45 ECTS cr.), as well as engineering and business administration. It is possible to create an individual degree profile through 15 ECTS credits of elective courses in engineering physics and engineering and 15 ECTS credits of optional courses. The programme concludes with a degree project in engineering physics (30 ECTS cr.).

### **Degree Title**

Upon request, the university issues degree certificates to students who fulfil all requirements.

Degree title:

Master of Science in Engineering Physics

Civilingenjörsexamen i teknisk fysik

### **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.