

Programme Syllabus

Master Programme in Materials Engineering and Product Development 120 Credits*

Masterprogram i Materialteknik och Produktutveckling 120 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 (120 credits), the student shall

- demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and
- demonstrate specialised methodological knowledge in the main field of study

Competence and skills

For the degree of Master (120 credits), the student shall

- demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information,
- demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work,
- demonstrate the ability in speech and writing both nationally and internationally to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Judgement and approach

For a Degree of Master (120 credits) the student shall

- demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work,
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Independent project (degree project)

A requirement for the award of a Degree of Master (120 credits) is completion by the student of an independent project (degree project) for at least 30 credits in the main field of study. The degree project may comprise less than 30 credits, however no less than 15 credits, if the student has already completed an independent project in the second cycle for at least 15 credits in the main field of study or the equivalent from a programme of study outside Sweden.

Miscellaneous

Specific requirements determined by the each higher education institution itself within the parameters of the requirements laid down in this qualification descriptor shall also apply for a Degree of Master (120 credits) with a defined specialization.

1.3 Objectives of the Programme

In addition to the objectives referred to in the Higher Education Act (see 1.2 above), a student graduating from the master's programme in Materials Engineering and Product

Development shall have the following knowledge, skills, and judgement abilities.

Knowledge and understanding

- show in-depth understanding of various mechanical properties of metallic materials to develop more efficient processes and materials,
- demonstrate advanced knowledge of characterisation methods of materials and their applications so as to understand the mechanical, surface, and tribological properties of various components produced by different methods and metallic materials,
- demonstrate knowledge and understanding of various factors that influence materials and processes selection in production, distribution, usage, and recycling,
- demonstrate knowledge and understanding of the product development process and the factors that drive the product modularisation,
- demonstrate knowledge in non-linear finite element analysis with emphasis on material models.

Competence and skills

- demonstrate the ability, with an engineering approach, to solve problems related to industrial materials,
- demonstrate the skill and ability to plan, implement, evaluate, and present projects orally and in written form in English,
- demonstrate the ability to analyse problems in a structured way using problem-solving methods,
- demonstrate the ability to create modular product concepts and to assess the impact of different alternatives through the product lifecycle.

Judgement and approach

- evaluate complex engineering problems in terms of materials and/or product development from a holistic perspective, which can be incompletely defined and which can contain conflicting information,
- demonstrate the ability to evaluate different materials engineering and product development solutions by taking technical, social, economic, and environmental aspects into account.

2. Main Structure of the Programme

The programme provides detailed understanding of the connections between Product Development - Production - Microstructure - Properties – Performance - Economy of various products. Upon completion of the programme, the students shall have acquired the necessary competence and skills to be innovative technical problem-solvers with

knowledge of materials engineering and product development.

The structure of the programme is designed to make it easier for students to incorporate in-depth knowledge in materials engineering in the product development process, especially in surface engineering and advanced materials characterisation.

The principles and methods for materials characterisation with respect to mechanical properties, structure, and composition in both theoretical and practical terms are given in the courses in mechanical properties of metals and materials and surface characterisation. The course in powder metallurgy with additive manufacturing introduces the fundamental concepts of powder metallurgy with a focus on additive manufacturing. The course in materials selection and design addresses various factors that influence material selection in production, distribution, consumption, and recycling of various products. The course in surface engineering and tribology covers main aspects of surface treatment methods to improve the mechanical and tribological properties of materials. The course failure analysis and prevention applies and combines theoretical and practical knowledge from the program's other courses in order to interpret and solve industrial material problems and to suggest new manufacturing processes and material selection.

The product development part of the programme focuses on providing knowledge about modularity and its benefits in the area of design, production, cost, and quality, and provides students with an understanding of the problems that can arise in the development of a modularised product range. In addition, problem-solving focuses on improving students' ability to find solutions to engineering problems in general through the application of structured methods.

The programme concludes with the completion of a 30-credit degree project that further enables students to develop better knowledge and understanding related to both materials engineering and product development.

3. Courses of the Programme

Year 1

- Project Management, 7.5 Credits (First Cycle, Industrial Economy)
- Mechanical Properties of Metals, 7.5 Credits (First Cycle, Materials Technology)
- Powder Metallurgy with Additive Manufacturing, 7.5 Credits (First Cycle, Materials Technology)
- Materials and Surface Characterisation, 7.5 Credits (Second Cycle, Materials Technology)
- Surface Engineering and Tribology, 7.5 Credits (Second Cycle, Materials Technology)

- Product Development Methods, 15 Credits (Second Cycle, Mechanical Engineering)
- Problem-Solving, 7.5 Credits (Second Cycle, Mechanical Engineering)

Year 2

- Solid Mechanics advanced course, 7.5 Credits (Second Cycle, Mechanical Engineering)
- Materials Selection and Design, 7.5 Credits (Second Cycle, Materials Technology)
- Advanced FEM, 7.5 Credits (Second Cycle, Mechanical Engineering)
- Failure Analysis and Prevention, 7.5 Credits (Second Cycle, Materials Technology)
- Degree Thesis in Materials Engineering, 30 Credits (Second Cycle, Materials Technology)

4. Degree Awarded

Degree of Master of Science (120 credits), Main Field of Study: Materials Technology (Teknologie Masterexamen, Huvudområde: Materialteknik).

5. Required Entry Qualifications

Bachelor of Engineering (Mechanical, Metallurgy, Materials Science, Production Engineering) of at least 180 credits and English 6

6. Other Information

The language of instruction in the Master's Programme in Materials Engineering and Product Development is English.

Approved:

Approved by the Faculty Board Science and Technology 13 June 2018

Valid from Autumn semester 2018

Revised:

Revised, 23 May 2019

Revision is valid from Spring semester 2019