

## Programme Syllabus

### **Master's Programme (one year) in Materials Engineering 60 Credits\***

Magisterprogram i Materialteknik 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 their 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 to perform 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 subject area and deeper knowledge of certain parts of the subject area as well as insight into current research and development in the subject area, and
- demonstrate advanced methodological awareness in the main subject area of the programme.

Skills and ability

For the degree of Master, the student must

- Demonstrate an ability to integrate knowledge and to analyse, judge and work with 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 with 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 terms of how it is used, and
- demonstrate the ability to identify his or her own need for further knowledge and to take responsibility for the development of his or her own knowledge.

#### Independent Work (Degree Project)

For a degree of Master the student shall, within the framework of the course requirements, complete an independent work (degree project) of at least 15 credits in the main field of study.

#### Other

For a degree of Master with a certain specialization, the specific requirements shall also be applicable as each institute of higher education itself decides upon the requirements that relate to this programme syllabus.

### 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 Masters Programme (one year) in Materials Engineering should have the following knowledge, skills, and assessment abilities.

#### Knowledge and understanding

- Demonstrate detailed understanding of the relationship between the structure of metallic materials, properties and their use,
- demonstrate advanced knowledge regarding mechanical and tribological properties of metallic materials, and the properties of surfaces, modification and characterization,
- demonstrate knowledge and understanding of the manufacturing of the materials from a performance, economic, ecological and ethical perspective,
- demonstrate detailed knowledge of materials characterization and its application in the failure analysis, and the principles to prevent failure of a component,
- demonstrate knowledge and understanding of the characteristics of an engineering

approach to solve a technical problem of the materials.

#### Skills and abilities

- Demonstrate the ability with an engineering approach to solve a technical material-related problem,
- demonstrate the skill and ability to plan, implement, evaluate and present oral and written projects based on various forms of materials testing and materials characterization of metallic materials and their surfaces,
- demonstrate the ability to effectively plan and carry out the tasks in projects.

#### Evaluation ability and approach

- Evaluate complex engineering problems in terms of materials from a holistic perspective, which can be incompletely defined and contain conflicting information,
- demonstrate the ability to evaluate different materials solutions for the metal and engineering industry by taking technical, economic and environmental aspects into account, given important ethical and sustainable views.

## 2. Main Structure of the Programme

The programme focuses on the structure and properties of metallic materials, and is applicable in terms of both the metal and engineering industry. The focus is on a detailed understanding of the connection between Production - Microstructure - Properties - Performance. Materials characterization is the hallmark of the programme.

This programme consists of in depth studies at advanced level within the main discipline of materials technology. 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 programme concludes with the completion of a 15-credit degree project that further enables students to form better knowledge and understanding related to both materials and surface engineering.

### **3. Courses of the Programme**

#### Semester 1

Mechanical Properties of Metals, 7.5 Credits (First Cycle, Materials Technology)

Materials Selection and Design, 7.5 Credits (Second Cycle, Materials Technology)

Powder Metallurgy with Additive Manufacturing, 7.5 Credits (First Cycle, Materials Technology)

Materials and Surface Characterization, 7.5 credits (Second Cycle, Materials Technology)

#### Semester 2

Surface Engineering and Tribology, 7.5 credits (Second Cycle, Materials Technology)

Failure Analysis and Prevention, 7.5 credits (Second, Materials Technology)

Thesis for master's degree (one year) in Materials Technology, 15 credits (Second Cycle, Materials Technology)

### **4. Degree Awarded**

Degree of Master of Science (60 credits), Main Field of Study: Materials Technology.

Teknologie magisterexamen, huvudområde: materialteknik. (Degree of Master of Science (60 credits), Main Field of Study: Materials Technology).

### **5. Required Entry Qualifications**

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

#### **Approved:**

Approved by the Faculty Board Science and Technology 10 September 2020

Valid from Autumn semester 2021