



Faculty of Health, Science and Technology  
Materials Engineering

# Syllabus

## Materials Engineering I

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| <b>Course Code:</b>                | MTGA10   |
| <b>Course Title:</b>               | Materials Engineering I<br><i>Materialteknik I</i>                   |
| <b>Credits:</b>                    | 7.5  |
| <b>Degree Level:</b>               | Undergraduate level  |
| <b>Progressive Specialisation:</b> | First cycle, has only upper-secondary level entry requirements (G1N) |

**Major Field of Study:**  
MTA (Mechanical Engineering)

### Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2023-01-31, and is valid from the Autumn semester 2023 at Karlstad University.

### Prerequisites

General admission requirements plus upper secondary level Physics 2, Chemistry 1, and Mathematics 3C/Mathematics D, or equivalent

### Learning Outcomes

The aim of the course is for students to obtain the basic knowledge of materials engineering needed to understand materials-related issues in design and manufacturing. Much attention is devoted to concepts and terminology as well as the connection between the mechanical properties and the microstructure of materials. The course covers engineering materials in the groups metals, polymers, and ceramics.

Upon completion of the course, students should be able to:

- give an account of mechanical properties and mechanical testing
- describe the atomic structure and interatomic bonding of solid materials

- give an account of crystal defects and their significance in thermal and mechanical processes
- give an account of the connection between mechanical properties and the microstructure of materials
- describe and identify different types of fracture: brittle, ductile, creep, and fatigue fractures
- use binary phase diagrams as well as isothermal and continuous cooling transformation diagrams to interpret microstructures and describe their development in phase transformations
- give an account of the purpose and procedure of common heat treatments
- describe and identify the most common types of corrosion of metallic materials
- give an account of the properties of the different types of polymeric materials: amorphous and semi-crystalline thermoplastics, rubber, and thermosetting polymers
- describe in general terms the main types of metallic, ceramic, and polymeric engineering materials, their properties, and applications
- use the basic Swedish terminology of materials engineering correctly in order to discuss materials issues, with materials specialists as well as non-specialists
- assimilate information about materials engineering in English.

### **Content**

Special emphasis is placed on concepts and terminology as well as the connection between mechanical properties and the microstructure of materials.

The course includes the following:

- lectures and seminars treating mechanical properties and testing, deformation mechanisms, strengthening mechanisms, fractures, phase transformations, phase diagrams, transformation diagrams, heat treatment, and corrosion, as well as the structure, properties, and applications of metallic, ceramic, and polymeric engineering materials
- mandatory laboratory assignments where students are trained in the use of light microscopes, scanning electron microscope, and equipment for mechanical testing (tensile, impact, and hardness tests).

### **Reading List**

See separate document.

### **Examination**

Examination is in the form of a written exam, laboratory work, hand-in assignments, and laboratory reports.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

### **Grades**

One of the grades Fail (U), Pass (3), Some Distinction (4), or Distinction (5) is awarded in the examination of the course.

### **Quality Assurance**

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

### **Course Certificate**

A course certificate will be provided upon request.

**Additional information**

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