



## Course syllabus

Faculty of Technology

Department of Mechanical Engineering

4MT330 Konstruktionsmaterial, avancerad kurs, 7,5 högskolepoäng  
Engineering Materials, advanced course, 7.5 credits

### **Main field of study**

Mechanical Engineering

### **Subject**

Mechanical Engineering

### **Level**

Second cycle

### **Progression**

A1N

### **Date of Ratification**

Approved 2024-12-02.

The course syllabus is valid from autumn semester 2025.

### **Prerequisites**

Undergraduate degree (180 credits) comprises at least 90 credits in Mechanical Engineering, of which a degree project of 15 credits, including Mathematics for engineers with Algebra and Calculus, 22.5 credits, Material Technology, 7.5 credits, Physics or Mechanics, 7.5 credits and Solid Mechanics, 7.5 credits or equivalent. English 6 or equivalent.

### **Objectives**

After completing the course, the student shall be able to:

- Thoroughly describe advanced engineering materials and their properties and applications, and critically discuss existing and potential areas of use for advanced materials.
- Provide an in-depth explanation of advances in material development and the

importance of representative models of mechanical behavior at different length scales.

- Apply micromechanical computational methods such as homogenization, representative volume elements (RVE), and finite element methods to represent materials and structures at different scales.
- Apply appropriate constitutive models using a multiscale analysis approach for material characterization, analysis, and design in engineering applications.
- Explain how materials influence a product's life cycle and environmental impact.
- Apply computational tools to improve the efficiency of the design process—from material structure to finished product—and to ensure sustainable use of resources.

## Content

The course includes the following components:

### **Advanced Materials Science**

- Overview of advanced engineering materials, their classification, and areas of application
- Overview of properties such as anisotropy, elasticity, plasticity, viscoelasticity, failure mechanisms, fracture behavior, crystal structures, and the properties of the constituents of composite materials
- Micromechanical experimental material characterization and modeling methods
- Correlation between microstructure and macroscopic properties

### **Computational Methods in Materials Science**

- Multiscale modeling and simulation techniques at different length scales
- Microscale modeling of heterogeneous structures using homogenization, representative volume elements (RVE), unit cells, and finite element methods

## Type of Instruction

Teaching consists of lectures, exercises, and project work. Certain components of the course are mandatory. Attendance at the final project presentation is compulsory. Information about mandatory components is provided at the start of the course and in the schedule.

## Examination

The course is assessed with the grades A, B, C, D, E or F.

The grade A constitutes the highest grade level, the remaining grades follow in descending order where the grade E constitutes the lowest grade level for passing. The grade F means that the student's performance has been assessed as failed.

Assignments and the project work are assessed using the grades Pass and Fail (P/F).

The course is examined through:

- Group project work (1.5 credits) (P/F)
- Individual assignments (1 credit) (P/F)
- Written examination (5 credits) (A–F)

To pass the course, a passing grade is required for the project work, assignments, and the written examination. The grade from the written examination determines the final course grade.

Resit examination is offered in accordance with Linnaeus University's Local regulations for courses and examination at the first- and second-cycle levels. In the event that a student with a disability is entitled to special study support, the examiner will decide on adapted or alternative examination arrangements.

## Course Evaluation

A course evaluation should be conducted during the course or in connection with its conclusion. The results and analysis of the completed course evaluation should be promptly communicated to students who have completed the course. Students participating in the next course instance should be informed of the results of the previous course evaluation and any improvements that have been made, no later than at the start of the course.

## Required Reading and Additional Study Material

### Required Reading

Callister William D., Rethwisch David G. *Callister's Materials Science and Engineering*, Global Edition, 2018, ISBN: 978-1-119-40549-8, (944 pages)

### Reference Literature

Barbero Ever J. *Introduction to Composite Materials Design - Third Edition*, , CRC Press, 2018, ISBN-10: 1-138-19680-0, (534 pages)

Aboudi Jacob, Arnold Steven M. and Bednarczyk Brett A. *Micromechanics of Composite Materials*, 2013, ISBN-978-0-12-397035-0 (984 pages)

Additional literature may be used.