



Faculty of Health, Science and Technology  
Materials Science

# Syllabus

## Simulation and modelling

<b>Course Code:</b>	MTAD13
<b>Course Title:</b>	Simulation and modelling <i>Simulering och modellering</i>
<b>Credits:</b>	7.5
<b>Degree Level:</b>	Master's level
<b>Progressive Specialisation:</b>	Second cycle, has only first-cycle course/s as entry requirements (A1N)

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

### Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2014-12-10, and is valid from the Spring semester 2015 at Karlstad University.

### Prerequisites

Mechanical Engineering 75 ECTS credits, including materials engineering courses 15 ECTS cr, solid state mechanics 7.5 ECTS cr, and linear algebra 7.5 ECTS cr, finite element methods 7.5 ECTS cr, or equivalent.

### Learning Outcomes

The aim of the course is that students acquire basic knowledge of frequently used materials models and calculation methods and the skills to apply them with the Finite Element Method (FEM).

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

- give an account of basic tensor analysis with cartesian tensors,
- give an account of viscoelasticity theory and anisotropic elasticity,
- analyse simple problems with viscoelastic or elastic anisotropic materials description both analytically and with FEM,
- give an account of different common yield criteria,
- give an account of rubber elasticity and of analysis with regard to severe deformations,
- give an account of explicit and implicit methods for analysing transient dynamic processes,
- perform dynamic analysis of mechanical systems with FEM,
- give an account of linear fracture analysis and apply FEM to analyse fracture mechanics problems,
- give an account of how contact analysis can be performed with FEM.

### Content

The course consists of equal parts of lectures and computer laboratory exercises. The exercises primarily involve mandatory hand-in assignments.

The lectures cover the following components:

- basic tensor analysis with cartesian tensors
- linear viscoelasticity theory, anisotropic elasticity, yield criteria and plasticity theory
- theory of severe deformation and rubber elasticity
- linear fracture mechanics analysis, calculation of stress intensity factors
- contact analysis with FEM
- dynamic analysis with FEM

### **Reading List**

See separate document.

### **Examination**

Assessment is based on hand-in assignments and a written exam.

### **Grades**

One of the grades Fail, 3 (Pass), 4 (Some Distinction), or 5 (Distinction) 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**

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission.

Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

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