

# Engineering Materials - Deformation and Fracture

Programme course

6 credits

Konstruktionsmaterial - deformationer och brott

TMKM90

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Mechanical Engineering  
and Design

**Date determined**

2017-01-25

## Main field of study

Mechanical Engineering

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Mechanical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Mechanical Engineering, Master's programme

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Engineering Materials, Solid Mechanics

## Intended learning outcomes

The objective of this course is to develop a broad understanding of deformation and fracture phenomena in metallic materials in the context of material processing and in-service performance. Mechanical behavior is approached through integration of the materials microstructure and continuum mechanics principles over a range of length scales. The course shall give knowledge about modern techniques for materials characterization and develop skills to evaluate the results from tests of the materials

mechanical properties.

After completion of the course the students should be able to:

1. Explain and describe basic concepts, relationships and models for deformation and failure mechanisms in metallic structural materials, (e.g. dislocation theory, creep mechanisms, basic fracture mechanics and fatigue theory)
2. Apply the relationship between the materials microstructure and the mechanical properties, such as principles of strengthening mechanisms and micro-structural effects on fracture toughness, creep and fatigue 3. properties. 3
3. Analyze and evaluate mechanical testing from an engineering perspective, especially creep testing, fatigue testing and fracture toughness testing. 4li>Analyze and explain real failures from a engineering materials perspective.
4. Make assessments and generalize about the validity of different material models used in the strength and service life calculations of real components.

## Course content

Elastic and plastic response of metallic engineering materials, strengthening mechanisms, time dependent deformation and creep mechanisms, fracture mechanics, fracture toughness, environmental impact on fracture and failures, Crack initiation and crack propagation.

## Teaching and working methods

The course contains lectures, tutorials, home work assignments and a mandatory laboratory exercise. The lectures focus on the theoretical aspects connected to learning objectives 1 and 2. The main focus for the tutorials is to strengthen the students ability to independently solve problems associated to learning objectives 2 and 3. The home work assignment and the laboratory exercise will additional training in analyzing and evaluate the course the content with respect to learning objectives 3, 4 and 5.

## Examination

TEN1	Written Examination	U, 3, 4, 5	4.5 credits
LAB1	Laboratory Work	U, G	1.5 credits

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Other information

Supplementary courses: New materials, Light weight materials, Experimental evaluation of engineering materials

## Department

Institutionen för ekonomisk och industriell utveckling

## Director of Studies or equivalent

Mikael Segersäll

## Examiner

Ru Lin Peng

## Course website and other links

<http://www.iei.liu.se/kmt/education/deformation-fracture?l=en>

## Education components

Preliminär schemalagd tid: 58 h  
Rekommenderad självstudietid: 102 h

## Course literature

### Kompletterande litteratur

#### Böcker

Hertzberg, *Deformation and fracture mechanics of engineering materials*

#### Kompendier

# Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).