SYLLABUS

Material mechanics 7.5 credits T7016T

Materialmekanik

Course syllabus admitted: Autumn 2024 Sp 1 - Present

DECISION DATE
2024-02-15

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LULEÅ TEKNISKA UNIVERSITET

Material mechanics 7.5 credits T7016T

Materialmekanik

Second cycle, T7016T

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Materialmekanik	Materials Technology

Main field of study

Materials Science and Engineering

Entry requirements

Basic knowledge and partial differential equations, Newton\'s method for solving nonlinear equations, Foundations in solid mechanics (stress, strain, equilibrium, elasticity , von Mises equivalent stress, programming using Matlab and ability to write technical reports.

Selection

The selection is based on 30-285 credits

Course Aim

Course aims are divided into the three categories below, you as a student should be able to do the following after completing the course:

1. Knowledge and understanding

- describe the material modelling process and understand the function of constitutive models
- describe the physical processes that cause plastic deformation, especially dislocation movements
- describe the diffusion processes that cause creep in a metallic material.
- show how phase transformations can cause deformations in a metallic material

2. Skill and ability

- formulate the theory of plasticity for the so-called deviatoric plasticity, and give examples of models for viscoplasticity and creep
- formulate a plasticity model and determine it’s parameters

3. Judgment and attitude

- describe the algorithm used in finite element programs for calculation of stress and be able to make minor changes in the algorithm
- describe the dislocation density model for yield stress calculation
- assess what properties a material model needs to have in order to be used in different situations

Contents

- Overview of different related phenomena and the role of material models in modelling
- Physical basis for plasticity
- Uniaxial plasticity and common empirical constitutive models
- Physical basis for creep
- The stress-strain algorithm in FEM programs
- Optimisation of material parameters
- Models for phase transformations
- Physically based constitutive model (the dislocation density model)

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.

The course consists of lectures, self studies, and two major assignments with written reports

The first assignment deals with different deformation mechanisms and the students are expected to describe the theory behind these deformation mechanisms and produce a deformation mechanism map for a given metallic material. The second assignment deals with the optimisation of constitutive models where parameters for a couple of models are to be determined. The work with the assignments can be performed individually or in groups with a maximum of two participants.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.
For a passing grade on the corse, correctly solved solutions for problems from the course literature, an approved written report for one assignments as well as a passing grade on the written exam is required. The design and quality of the report is included in the assessment

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Transition terms

2113

Course offered by

Department of Engineering Sciences and Mathematics

LULEÅ TEKNISKA UNIVERSITET

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0003	Homework assignments	U G#	2	Mandatory	A21	
0006	Written exam	G U 3 4 5	3	Mandatory	A24	
0007	Report	G U 3 4 5	2.5	Mandatory	A24	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Nils Almqvist, Head of Undergraduate Education 2024-02-15

Syllabus established

The syllabus was established by the Department of Applied Physics and Mechanical Engineering 2007-12-17, and remains valid from autumn 2008.

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