

**SYLLABUS**

# **Composites: Design and Numerical Methods 7.5 credits T7020T**

**Kompositer, Design & Numeriska Metoder**

**Course syllabus admitted: Autumn 2023 Sp 1 - Present**

**DECISION DATE  
2020-11-03**

# Composites: Design and Numerical Methods 7.5 credits T7020T

## Kompositer, Design & Numeriska Metoder

### Second cycle, T7020T

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

### Main field of study

Materials Science and Engineering

## Entry requirements

Basic knowledge in elasticity theory. Basic course on Composite Materials (T7012T) or similar

## Selection

The selection is based on 30-285 credits

## Course Aim

At the end of the course student will have ability

- to formulate material models and perform numerical parametric analysis (FEM) of composites properties
- to plan and perform mechanical testing of composites and analyze mechanical properties
- to formulate boundary value problems for simple structures, analyze stress concentrations and failure sequence in composite structures
- to design and optimize composite structures combining numerical simulations with experiments.
- to apply homogenization techniques and analysis on multiple length scales
- to work in a team with a role as a team member and as a leader
- to analyze results and to present the orally and in a form of technical report

## Contents

The course starts with application of numerical and sophisticated analytical methods to analyze mechanical performance of hierarchical composite materials on multiple length scales. A significant part of the course is aimed to structures made of composite materials and subjected to thermo-mechanical loads. This part includes: use of commercial software LAP for laminate analysis; analysis of equilibrium equations and boundary conditions for shells and laminated plates; methods of analytical solutions for simplest cases; application of FEM (ANSYS); analysis of damage initiation, development and final failure; mechanical testing of composite materials and structures (methods, design and analysis); FEM simulations of tests and structural performance etc. Design principles with composites in aerospace, car and wind energy applications. Project on own design of load bearing composite structure including simulations, manufacturing and experimental verification.

## 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 and a project work in groups of 3-4 students. Project includes design and numerical (FEM) simulations, manufacturing of composite structure and experimental verification. The results of the project work are presented in a written report and orally. Theoretical skills will be improved by individual work with support from the lectures and will be examined in a written exam.

## 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. The examination will consist of oral exam and evaluation of the written and orally presented project report. Both these examination parts will be graded.

## 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.

## Remarks

Good knowledge in English.

## Course offered by

Department of Engineering Sciences and Mathematics

## Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0003	Oral Exam	G U 3 4 5	2	Mandatory	A14	
0004	Project Work	U G#	5.5	Mandatory	A14	

## 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 Niklas Lehto, Head of Undergraduate Education 2020-11-03

## Syllabus established

by Dept. TVM Mats Näsström 2012-03-14