

*Course syllabus*

# Konstruktion i polymera kompositmaterial

## Design in Polymer Composite Materials

**MMKN41, 7,5 credits, A (Second Cycle)**

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED M

**Date of Decision:** 2023-04-11

### General Information

**Elective for:** M4-pu, MD4

**Language of instruction:** The course will be given in English

### Aim

Based on the most recent research findings the course aims to provide students with knowledge and insights that are essential for the engineering designer to design and manufacture robust and cost-efficient products based on polymer composites. Topics that are included in the course are e.g. selection of fibers and matrices, design procedure, and manufacturing methods. The course also provides knowledge about cost analysis. In each of the topics qualitative as well as quantitative methods are discussed.

### Learning outcomes

*Knowledge and understanding*

For a passing grade the student must

- for a given conceptual design propose suitable fibers and matrices
- for a given conceptual design propose a suitable design
- based on the design solution propose a suitable manufacturing method
- calculate the actual costs associated with the given design

### *Competences and skills*

For a passing grade the student must

- be able to independently, based on a given conceptual design, select suitable fibers and matrices
- be able to independently, or in a group, develop a unique engineering design solution
- be able to independently or in a group, in dialogue, communicate orally and in writing the engineering design solution developed to representatives of an industrial company or the equivalent

### *Judgement and approach*

For a passing grade the student must

- in a research based way be able to reflect on the engineering design solutions developed and on the basis of that propose additional and/or alternative engineering design solutions
- be able to suggest the need for further and/or alternative engineering design solutions

## Contents

To ensure that the most recent research findings are presented in the course, external lecturers with links to research will be invited. During the course the students will get access to the latest research results in actual areas, to enable independent and well thought out assessments.

During the first phase of the course, current polymer composite materials will be presented and discussed, with reference to material properties and costs. Then, a description of the most common manufacturing techniques for polymer composite material is given. After this part, i.e. presentation of the most common constituents and manufacturing techniques, the course mainly focus on design aspects for polymer composite materials. Mechanical and thermal properties, and techniques to measure these properties, are presented and reasons for damage and fracture are discussed in detail. The major part of the course is devoted to composite mechanics (laminate theory) and design methodology. During these lectures, calculations and design guidelines are presented. The lectures are complemented by exercises/examples. The theoretical part of the course is ended by a description of the state-of-the-art regarding new types of polymer composites, such as nano-composites and bio-composites. A short description of sandwich construction is also included at the end of the course.

After the theoretical part of the course a design project is carried out. The project follows the topics covered in the lectures. Each part of the project will be checked by the supervisor.

## Examination details

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)

**Assessment:** The course includes a compulsory design project, which is carried out in teams of 3-5 students. Approved projects earn a score in the range 20 to 40 points. All team members receive the same number of points. In addition, the students must pass an individual written exam by receiving a score of minimum 30 points. The final result is based on the sum of the points earned on the project and the written exam.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

### **Parts**

**Code:** 0117. **Name:** Project Work.

**Credits:** 2,5. **Grading scale:** UG. **Assessment:** The course project is carried out in groups of 3-5 students. The student must receive at least 20 points to be approved. All group members receive the same number of points earned on the projects. **Contents:** The project consists of the following parts; analysis and establishment of product specifications, selection of material and manufacturing technique, establishment of the embodiment design and cost analysis. The project work also includes a presentation of the results generated.

**Code:** 0217. **Name:** Examination.

**Credits:** 5. **Grading scale:** UG. **Assessment:** In order to pass the written exam, the student must earn a score of 30-60 points. **Contents:** The written examination covers the theory presented in the course.

## **Admission**

**Assumed prior knowledge:** FHLF15 Solid Mechanics, Basic Course and FKMA01 Materials Engineering, Basic Course

**The number of participants is limited to:** No

**The course overlaps following course/s:** MMKN40

## **Reading list**

- The course literature is provided by the department as research based articles and papers, compendium and references to books and e-books.

## **Contact and other information**

**Course coordinator:** Anders Sjögren, anders.sjogren@design.lth.se

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**Course homepage:** <http://www.product.lth.se/education/>