



COURSE SYLLABUS

Polymer and Composite Technology, 7.5 credits

Polymer och komposit teknologi, 7,5 högskolepoäng

Course Code: TPKR21	Education Cycle: Second-cycle level
Confirmed by: Dean Mar 1, 2021	Disciplinary domain: Technology
Revised by: Director of Education Oct 25, 2023	Subject group: MA2
Valid From: Aug 1, 2024	Specialised in: A1N
Version: 3	Main field of study: Product Development

Intended Learning Outcomes (ILO)

After a successful course, the student shall:

Knowledge and understanding

- show familiarity with the structure of polymeric materials and their relationship with physical, chemical, and mechanical properties
- display knowledge in the processing of polymers, product design, and quality control by different testing methods
- display knowledge of the relationship between man, material, and environment
- display knowledge on applications of materials
- display knowledge on the selection and application of materials and material solutions pertaining to everyday rudimentary engineering challenges

Skills and abilities

- demonstrate the ability to analyze, characterize, and develop the scientific research methodology to deal with the product development challenges

Judgement and approach

- demonstrate the ability to independently identify and critically analyze the engineering problems related to material selection, product design, manufacturing, and environmental concerns
- demonstrate an understanding of trade-offs or compromises made during product design to meet the conflicting constraints that arise from four building blocks of plastic-part design, i.e. material, product design, mold design, and process

Contents

The polymers are so deeply entrenched in our day-to-day life that it is hard to imagine a life without them. This course has been designed to provide a polymer material science background to engineering students. The contents of the course are meticulously tailored to meet industrial challenges such as material design, product design, sustainability, processing, and optimization of the products.

The course includes the following elements:

- The study of polymeric structures and their relationship with the physical, mechanical, chemical, and processing properties of the polymer. The structural properties of polymer play a fundamental role in ascertaining many physical and chemical properties. Properties such as density, stiffness, ductility, strength, melting points, glass-transition temperature, etc. are related to the molecular structure, degree of crystallinity, and cross-linking. The course includes a thorough understanding of molecular architecture and how by harnessing molecular structure the physical, mechanical, and chemical properties can be tailored.
- Composite materials are replacing traditional materials in many structural applications. Primarily automotive and aerospace applications of polymer-based composite materials have drastically surge research and development activities. In this part, we will learn polymer-based composites, their types, mechanics, manufacturing, and applications.
- Polymeric materials are touching our everyday life. Besides their outstanding properties, ease of manufacturing is one of the qualities which makes their widespread use possible. In this course we will discuss the four building blocks of manufacturing which are given below:

Materials: the significance of material selection and its role in terms of cost, processing, performance, and environment.

Product Design: In this part, we will study how a designer must design a product to satisfy the functional, structural, processing, environmental, cost, and aesthetic requirements.

Mold Design and Machining: The mold design is perhaps the most critical part of manufacturing. In this part, we will learn the fundamentals of mold design and the ways to minimize manufacturing cost by redesigning the products to optimize the time, material, energy, and functionality of the product.

Process: The mechanical properties are significantly affected by the process variable, such as temperature, pressure, viscosity, additives, and molding conditions. In this part, we will learn the correlation between different processing parameters and their effects on properties.

Type of instruction

Classroom lessons, video lessons, case studies, guest lectures, quizzes, laboratory sessions, industrial visits, assignments, and presentations.

The teaching is conducted in English.

Prerequisites

The applicant must hold the minimum of a bachelor's degree (i.e the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in materials and Manufacturing, Mechanical Engineering, Chemical Engineering, Product Development or Engineering Physics or equivalent. The bachelor's degree should comprise a minimum of 15 credits in mathematics. Proof of English proficiency is required.

Examination and grades

The course is graded 5,4,3 or Fail.

Registration of examination:

Name of the Test	Value	Grading
Written examination [†]	4 credits	5/4/3/U
Assignments	2 credits	U/G
Laboratory reports	1.5 credits	U/G

[†] Determines the final grade of the course, which is issued only when all course units have been passed.

Other information

Passing the written exam is necessary, to get the grades from the assignments and lab reports.

Course literature

The literature list for the course will be provided eight weeks before the course starts.

Principles of Polymer Engineering, N.G. McCrum, C.p. Buckley and C.B. Bucknall, second edition 1997 Oxford University press.