JÖNKÖPING UNIVERSITY
School of Engineering

COURSE SYLLABUS

Multidisciplinary Optimization, 7.5 credits

Multidisciplinär optimering, 7.5 högskolepoäng

Course Code:	TMOR25	Education Cycle:	Second-cycle level
Confirmed:	Feb 01, 2025	Disciplinary domain:	Natural sciences
Valid From:	Sep 01, 2025	Subject group:	Mathematics
		Specialised in:	A1N Second cycle, has only first-cycle course/s as entry requirements

Intended Learning Outcomes (ILO)

On completion of the course the student shall:

Knowledge and understanding

- display knowledge of different types of optimization algorithms and their use
- display knowledge in different types of optimization methods
- show understanding about how optimization is used in the realization of sustainable products

Skills and abilities

- demonstrate the ability to implement different optimization algorithms
- demonstrate the ability to apply optimization methods to solve engineering problems

Judgment and approach

- demonstrate the ability to critically evaluate suitable optimization methods for a given problem
- demonstrate the ability to critically assess the validity of optimization results

Content

The course enables engineering students to apply optimization methods in the engineering process to optimize various product realization aspects. The applications can be both broad and multidisciplinary, or highly specific centered around for example detailed engineering design.

The course includes the following elements:

- Basic programming: variables, lists, functions, flow control, etc.
- Derivatives in multiple dimensions, numerical and automatic differentiation
- Univariate optimization, local descent and line search
- First-order methods, second-order methods, direct methods and population based methods
- Constraints, Lagrange multipliers, KKT-conditions, penalty methods
- Sampling, surrogate models, multiobjective optimization, Pareto optimality

Type of instruction

Lectures, laborations and project work.

Language of instruction is in English.

Entry requirements

Passed courses of at least 150 credits in the program Industrial Product Realisation, or a bachelor's degree (i.e the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in Mechanical Engineering, Product Development, Materials Engineering, Manufacturing Engineering, Industrial Engineering, Civil or Construction Engineering, or the 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 U.

The final grade of the course is based on the result from the project, and is issued only when all course units have been passed. Both assignments and project work is examined individually.

Registration of examination:

Name of the Test	Value	Grading
Assignment	4.5 credits	G/U
Project	3 credits	5/4/3/U

Course literature

Please note that changes may be made to the reading list up until eight weeks before the start of the course.

Title: Algorithms for Optimization
Author: Kochenderfer M.J., Wheeler T.A
Publisher: MIT Press, 2019
ISBN: 9780262039420