UNIVERSITY OF SKÖVDE

TRANSLATION FROM SWEDISH

COURSE SYLLABUS

Optimisation-driven Design A1N

6 credits

Course code: VP762A
Version number: 4
Valid from: 1 January 2026
Ratified by: Curriculum Committee for Engineering Science
Date of ratification: 22 May 2025

1. General information about the course

The course is provided by the University of Skövde and is named Optimisation-driven Design A1N (Optimeringsdriven design A1N). It comprises 6 credits and is a second-cycle course. The level of progression is A1N.

The course is a part of the main field of study in Virtual Product Realization. The disciplinary domain of the course is Technology.

2. Entry requirements

A Bachelor's degree equivalent to a Swedish Kandidatexamen of 180 credits, with a major within mechanical engineering or production engineering (or the equivalent). Additionally, courses of at least 7.5 credits in Strength of Materials (or equivalent) and 7.5 credits in the Finite Element Method (or equivalent) are required.

A further requirement is proof of skills in English equivalent of studies at upper secondary level in Sweden, known as the Swedish course English 6 or English level 2 (or the equivalent). This is normally demonstrated by means of an internationally recognized language test, e.g. IELTS or TOEFL.

3. Course content

The course contains an introductory part about different ways of thinking about what optimization means and how optimization can be used to make the design process competitive. The course also covers basic optimization methods and problem formulations for these methods. During the remainder of the course, you will learn different solution methods to find solutions to optimization problems.

The course includes the following elements: introduction to optimization-driven design, structure optimization, size, shape and topology optimization, as well as surrogate optimization; steepest slope method, Newton's method, Karush-Kuhn-Tucker optimality conditions, Linear programming, Simplex method; sequential linear programming, sensitivity analysis; response surface optimization, successive response surface optimization, linear and quadratic response surfaces, normal equation, advanced surrogate models (Kriging and RBFN); experiment planning: Design of Experiments (DOE), Factor, Koshal, Box-Behnken, surface-centered, S-optimal experiment; and robustness analysis, normal distribution, histogram, box plots, scatter plots, Monte Carlo simulation.

4. Objectives

Knowledge and understanding

- demonstrate knowledge of how structure and construction optimization can be used in the design process,
- demonstrate knowledge of the use of basic optimization algorithms,
- show an understanding of how optimization-driven design creates sustainable construction solutions,

Skills and Abilities

- show ability to carry out response surface optimization of simpler structural problems,
- show ability to carry out simpler sensitivity analyses,

Evaluation ability and approach

- demonstrate the ability to implement larger projects within optimization-driven design.

5. Examination

The course is graded A (Excellent), B (Very good), C (Good), D (Satisfactory), E (Sufficient) or F (Fail).

Project presentation includes written report and oral presentation.

The examinations of the course consist of the following modes of assessment:

- **Project presentation**
  3 credits, grades: A/B/C/D/E/F (determines the final grade)
- **Laboratory assignment**
  3 credits, grades: G/U

Students with a permanent disability who have been approved for directed educational support may be offered adapted modes of assessment.

6. Types of instruction and language of instruction

The teaching comprises lectures and computer exercises.

The teaching is conducted in English.

7. Course literature and other educational materials

Compendium provided by the instructor.

8. Student influence

Student influence in the course is ensured by means of course evaluation. The students are informed about the results of the evaluation and potential measures that have been taken or are planned, based on the course evaluation.

9. Additional information

Further information about the course, as well as national and local governing documents for higher education, is available on the website of the University of Skövde.