



# SD2420 Advanced design of welded structures 6.0 credits

Avancerad dimensionering av svetsade konstruktioner

This is a translation of the Swedish, legally binding, course syllabus.

## Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

## Grading scale

P, F

## Education cycle

Second cycle

## Main field of study

## Specific prerequisites

FEM, Linear elastic fracture mechanics (LEFM) and basic knowledge in solid mechanics, material mechanics and fatigue.

English B / English 6

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

In order to guarantee the strength of a welded structures different design codes have been developed during the last 30 years and have been applicable within the manufacturing industry with low accuracy and precision. As the finite element analysis is nowadays a widely used tool new developed design codes are applicable with better accuracy and precision. After the course the student should be able to:

1. Chose method for fatigue life assessment with reasonable accuracy for different types of welded joints and structures.
2. Understand the effects of welding residual stress on the structural integrity.
3. Understand the influence of different types of weld defects and discontinuities on the the fatigue strength of welded joints.
4. Choose appropriate analysis method and perform fatigue life assessment of complex welded structures.
5. Chose relevant post weld improvement techniques for different welded applications.
6. Use weld quality systems.

## Course contents

This course discuss different advanced methods for fatigue design of welded structures; nominal stress method, hot spot (geometric/structural) stress method, effective notch stress method and applied linear elastic fracture mechanics (LEFM). Influence of different factors that effect the fatigue life and breakdown is discussed, such as; stress concentrations, weld defects, welding residual stresses, multiaxial stress states, etc. Different post weld improvement techniques in order to increase the weld quality and the fatigue strength of welded structures is discussed. Different weld class systems in order to assure the weld quality of welded joints in the design and during production is discussed and compared. Different design codes, guidelines for practice and recommendations for welded joints are discussed, e.g. IIW:s "recommendations for fatigue design of welded joints and components". Evaluation and fatigue design of welded structures using FEM is treated regarding; boundary conditions, accuracy, non-linearity, sub-modelling techniques, 3D effects. Different state-of-the art applied fracture mechanical softwares for prediction of the fatigue life of welded joints is presented, discussed and utilized.

## Examination

- BER2 - Assignment 2, 2.0 credits, grading scale: P, F
- BER1 - Assignment 1, 2.0 credits, grading scale: P, F
- LAB1 - Labs and assignments, 2.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Grading scale P/F

## Other requirements for final grade

LAB1 - 3 computerlabs/exercises on fatigue design and FEM. Examination by handing in lab report.

BER1 - 1 extensive home assignment on fatigue design of a welded structure. Examination; handed in report.

BER2 - 1 extensive home assignment and case study on fatigue design of a welded structure. Examination; handed in report.

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.