AF1024 Structural Analysis with Finite Element Methods (FEM) 7.5 credits

Strukturanalys med finita elementmetoder (FEM)

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

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

Establishment

Course syllabus for AF1024 valid from Autumn 2015

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

The students must have passed the following courses

Mathematics 1

HF1004 Mathematics and Statistics

HS1003 Structural Mechanics 1

HS1004 Structural Mechanics 2

HS1008 Structural Design in Civil Engineering

or equivalent courses

Language of instruction

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

Intended learning outcomes

The course covers both theoretical and more applied FEM modeling aspects. The course also provides the necessary knowledge above the beam theory in structural mechanics. An important goal of the course is to teach students to use a commercial FEM program by analyzing practical problems.

After completing the course the students shall be able to

- explain the basic theory behind the finite element method.

- derive 2D beam element and 4-node plane element.

- describe plate, shell and solid elements.

- use the finite element method to analyze real structures.

- use a commercial FE program.

- explain in which cases a simple dynamic analysis is needed, and the principles behind such analysis.

Course contents

Structural Mechanics:

multiaxial strains and stresses, principal stresses

dynamics: natural frequency, damping and resonance for simple systems

FEM theory:

discretization, interpolation functions, elements, nodes and degrees of freedom

internal and external work, virtual work

assembling, stiffness matrix

derivation of 2D beam element and 4-node plane element

description of the properties of plate, shell and 3D solid elements

FEM modeling:

choice of elements, boundary and support conditions

modeling of loads and details

modeling of concrete slabs

modeling of bridges

modeling of multistory frames

Course literature

Egen litteratur

rekommenderad (dock ej obligatoriskt): Cook, Malkus and Plesha, Concepts and applications of finite element analysis, John Wiley & Sons, 2002

Examination

- INL1 - Assignments, 3.5 credits, grading scale: P, F
- TEN1 - Written Exam, 4.0 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

TEN1 - Examination 4.0 credits, grade scale A-F

INL1 - Homeworks 3.5 credits, grade scale P,F

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.