Linnæus University

Jnr: 2014/3114-3.1.2

Course syllabus

Faculty of Technology
Department of Mechanical Engineering

4MT003 Finita elementmetoden, 7,5 högskolepoäng
The Finite Element Method, 7.5 credits

Main field of study
Mechanical Engineering

Subject Group
Mechanical Engineering

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved by Faculty of Technology 2014-10-03
The course syllabus is valid from autumn semester 2015

Prerequisites
Algebra and analysis corresponding to 22,5 credits in mathematics (from engineering programs). 7,5 credits in Mechanics of Materials or Solid Mechanics. 7,5 credits in Analysis of Structures (4BY066) or the equivalent
and English B.

Objectives

After completing the course the student is expected to be able to:

- account for the assumptions made in the classic equations for heat conduction and elasticity theory
- formulate on the basis of these assumptions the strong form of the equations and account for what types of boundary conditions may appear
- demonstrate skills in being able from the strong form of a partial differential equation to produce the corresponding

weak formulation and on the basis of this establish the finite element formulation for a given problem

- understand and demonstrate skills in how element approximations are implemented in computers and how these affect the accuracy of the solution
- show an understanding of and skills in how the finite element method is implemented in computers as well as be able to perform simple analyses in a computer

environment

- understand how a modern FEM program is built up and what sources of error may appear in different types of analysis

Content
The course comprises the following elements:

- Strong and weak formulations in one and several dimensions for heat conduction and elasticity problems, elastic beam bending
- Finite element formulations, shape functions - different approximations
- Constitutive relations (connections between stress - strain or flux - temperature gradients etc.)
- Principle stress, effective stress measures, yield stress
- Mappings - isoparametric elements, numerical integration, convergence properties.

Type of Instruction
The teaching consists of lectures, exercises and project work. Participation in the project assignments of the course is compulsory.

Examination
The course is assessed with the grades A, B, C, D, E, Fx or F.
The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student's performance is assessed as fail (i.e. received the grade F).

The assessment of student performances is usually written and takes place during special examination periods. The assessment may also be based on submitted presentations of project work and other assignments.

Course Evaluation
A course evaluation will be carried out and compiled after the course is completed. The compilation will be presented to the current board as well as to the students and filed.

Credit Overlap
The course cannot be included in a degree along with the following course/courses of which the content fully, or partly, corresponds to the content of this course:4MT001 The finite element method, 7,5 hec.

Other
Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

Required Reading and Additional Study Material
Required reading
N.S. Ottosen, H. Petersson; *Introduction to the Finite Element*, Prentice Hall, 1992. 410 pages.

K.-G. Olsson, S. Heyden, *Introduction to the finite element method - problems*, KFS, Lund, 2001.

P-E Austrell, O Dahlblom, J Lindemann, A Olsson, K-G Olsson, K Persson, H Petersson, M Ristinmaa, G Sandberg, P-A Wernberg, *CALFEM – A finite element toolbox, version 3.4*
Byggnadsmekanik och Hållfasthetslära, Lund, 1999. 285 pages.