Linnæus University

Course syllabus

Faculty Board of Science and Engineering
School of Engineering

4MT001 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 the Board of the School of Engineering 2009-11-16

Revised 2011-06-13

The course syllabus is valid from autumn semester 2011

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.

Expected learning outcomes

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 U,3,4 or 5.
On request, students may have their credits translated to ECTS-marks. Such a request must be sent to the examiner before the grading process starts.

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 written course evaluation will be carried out at the end of the course in accordance with the guidelines of the University. The course evaluation will be filed at the department.

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.