Faculty of Technology and Science
Mechanical Engineering

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Technology and Science on 21 April 2008 , and is valid from the Autumn semester of 2007 at Karlstad University.

Course Code: MSGC15
Finite Element Methods: Basics, 7.5 ECTS Credits
(Finita elementmetodens grunder, 7.5 Swedish credit points)
Degree Level: Bachelor
Progressive Specialisation: G1F (First cycle, has less than 60 credits in first-cycle course/s as entry requirements)

Language of Instruction
Swedish

Prerequisites
Mechanical engineering 30 ECTS cr (including mechanics and solid mechanics) plus mathematics 15 ECTS cr or equivalent

Major Field of Study
MTA (Mechanical Engineering)

Learning Outcomes

The aim of the course is that students acquire basic knowledge of the theoretical foundation of the Finite Element Method (FEM) and skills to use commercially available software for FEM to solve engineering problems.

Upon completion of the course, students should be able to:
- explain basic concepts such as node, element, degree of freedom and stiffness matrix,
- give an account of the meaning of the virtual work principle
- give an account of how the virtual work principle can be used combined with appropriate displcacement approaches to derive element stiffness matrixes for different types of mechanical element structutures such as bars, beams and disc elements,
- explain the meaning of isoparametric element and Galerkin's method,
- analyse structures of one and two dimensional bars and plane beams theoretically and with a commercial FEM-program,
- use disc, plate and shell elements to analyse strength engineering problems with the help of a commercial FEM-program,
- explain the meaning of material and geometric non-linearity problems respectively and analyse problems with elastic-plastic material description with the help of a commercial FEM-program,
- give an account ofthe Newton-Raphson method for solving non-linear problem witha variable,
- give an account of linear instability analysis with FEM,
- calculate neutral frequencies with the help of a commercial FEM-program,,
- explain the concept convergence and how divergence studies are performed with FEM,

- identify the cause of common types of problems in FEM-analysis.

Content and Form of Instruction

Instruction is in the form of lectures and exercises on:
- matrix statistics
- element stiffness matrixes for different types of elements, primarily bars, beams and plane elements
- assemblying stiffness matrix structures
-linear elastic analysis of elastic supporting bar structures, beam and shell constructions and plane and asymmetrical structures
. elastic-plastic analysis
- linear stability and neutral frequency analysis

Reading List

See separate document.

Examination

Examination is in the form of hand-in assignments and a written exam.

Grades

One of the grades Fail (U), 3 (Pass), 4 (Some Distinction), 5 (Distinction) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor's and Master's levels at Karlstad University stipulate the obligations and rights of students and staff.

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