COURSE SYLLABUS

Non-linear Finite Element Analysis, 9 credits

Olinjär FEA, 9 högskolepoäng

Course Code:	TOLR24	**Education Cycle:**	Second-cycle level
Confirmed by:	Dean Feb 27, 2014	**Disciplinary domain:**	Technology (95%) and social sciences (5%)
Revised by:	Director of Education May 9, 2016	**Subject group:**	MT1
Valid From:	Aug 1, 2016	**Specialised in:**	A1N
Version:	2	**Main field of study:**	Product Development
Reg number:	JTH 2016/1876-313		

Intended Learning Outcomes (ILO)

After completing the course, the student shall

Knowledge and understanding

- be able to knowledge of basic principles of nonlinear FEA, in particular the disciplines of contact mechanics, plasticity and transient problems
- be able to understanding for derivations of methods from governing equations

Skills and abilities

- be able to perform nonlinear FEA of real engineering problems such that a drop test or sheet metal forming
- be able to read a scientific paper within the field of nonlinear FEA without any need for understanding of the details

Judgement and approach

- be able to suggest appropriate analysis for different types of problems
- be able to judge and criticizes results from a finite analysis.

Contents

The course includes the following topics:
- Strong and weak formulations of a one-dimensional problem.
- Linear elasticity, continuum mechanics, stress, strain, balance laws, Eulerian and Lagrangian formulations.
- Finite element formulations, (strong and weak formulations), isoparametric formulation, numerical integration.
- Contact mechanics, Signorini's contact conditions, trial and error approach, penalty formulation, augmented Lagrangian formulation, Newton's method, the KKT-conditions.
- Plasticity, associative plasticity, the principle of maximal dissipation, J2-plasticity, radial return, isotropic hardening.
- Transient problems, implicit and explicit methods, Runga-Kutta's method, the central difference method, Newmark's method, eigen value problems.

- Projects and tutorial using Abaqus.

Type of instruction

Lectures, tutorials and home assignments.

The teaching is conducted in English.

Prerequisites

Passed courses 180 credits in first cycle, at least 90 credits within the major subject Mechanical Engineering, and 21 credits Mathematics, including at least 6 credits in multivariate calculus. Additionally, completed courses Applied Finite Element Analysis 6 credits and Simulation of Rigid Body System 7,5 credits or Mechanics 2, 6 credits (or the equivalent).

Examination and grades

The course is graded 5,4,3 or Fail.

Registration of examination:

Name of the Test	Value	Grading
Examination[I]	5 credits	5/4/3/U
Project work	4 credits	U/G

[I] Determines the final grade of the course, which is issued only when all course units have been passed.

Other information

Exemption from entry requirement allowed according to the selection groups of the program, where the course is included.

Course literature

Literature

The literature is preliminary until one month before the course starts.

Lecture notes, distributed electronically.