COURSE SYLLABUS

Mekanikens approximativa beräkningsmetoder 2:1

Computational Engineering 2:1

7.5 credits (7,5 högskolepoäng)

Course code: MT2560
Main field of study: Mechanical Engineering
Disciplinary domain: Technology
Education level: Second cycle
Specialization: A1F - Second cycle, has second cycle course/s as entry requirements

Subject area: Mechanical Engineering
Language of instruction: English
Applies from: 2018-08-01
Approved: 2018-03-01

1. **Decision**
   This course is established by Dean 2018-01-24. The course syllabus is approved by Head of Department of Mechanical Engineering 2018-03-01 and applies from 2018-08-01.

2. **Entry requirements**
   Admission to the course requires taken course Computational Engineering 1, 7.5 credits.

3. **Objective and content**

   3.1 Objective
   Student acquires in-depth knowledge and develops skills to apply the semi-analytical and numerical methods for computational engineering analysis for decision support in product development.

   Students develop their ability to formulate theoretical models and these derive appropriate mathematical equations, and solving them using appropriate methods.

   The student will receive an in-depth understanding of how existing calculation software works and an understanding of the capabilities and limitations of these.

   Students will increase their ability to self-develop complementary software for custom applications.

   Students increase their ability to apply scientific information and train their ability to communicate scientific facts.

   3.2 Content
   This course is a continuation of the course Mekanikens approximativa beräkningsmetoderc 1 / Computational Engineering 1, and also includes multi-dimensional problems. Students deepen their already acquired basic knowledge and skills in the subject. The various elements of the course are described briefly by the following keywords:
   • Numerical solution of partial differential equations,
   • Boundary Value Problems,
   • Separation of variables,
   • Analogy Methods
   • Finite difference method,
   • Adjustment of boundary conditions,
   • The finite element method,
   • Two-and three-dimensional element types,
   • Shape- and weight functions;
   • Approximate mapping,
   • Isoparametric elements,
   • Subdomains and node numbering,
   • Gauss integration,
   • Transient problems,
   • Nonlinear systems,
   • Coupled systems.

4. Learning outcomes

The following learning outcomes are examined in the course:

4.1 Knowledge and understanding

On completion of the course, the student will be able to:

• be able to show deeper knowledge and understanding of how semi- analytical and numerical methods can be used and be implemented in software for computational engineering analysis, providing decision support in product development.

4.2 Competence and skills

On completion of the course, the student will be able to:

• be able to derive governing equations for a given multidimensional initial- and/or boundary value problem

• be able to solve given types of equations with prescribed analytical and/or numerical method using own software implementation.

4.3 Judgement and approach

On completion of the course, the student will be able to:

• be able to interpret, validate and communicate analysis results.

5. Learning activities

The teaching comprises lectures, laboratory work, project work, seminars and exercises. Theories and methods are presented and discussed in the form of lectures / seminars. A number of exercise problems and a project supporting the learning and understanding of the theory. Students develop their own computer programs for solution of the given problems. Advantages and disadvantages of the methods are discussed based on this experience.

Applications are related to industry relevant problems.

6. Assessment and grading

Modes of examinations of the course

Code	Module	Credits	Grade
1810	Assignment	4 credits	AF
1820	Take-home examination	3.5 credits	AF

The course will be graded A Excellent, B Very good, C Good, D Satisfactory, E Sufficient, FX Fail, supplementation required, F Fail.

At grade FX on a module, the student will be given an opportunity to complement the work within 6 weeks for a grade E. The final grade is a weighted sum of all modules. Each module consists of several smaller oral and written tasks according to information given at the course start. All tasks of a module need to be approved to get approved on a module.

The course information for each course revision should include the assessment criteria and make explicit in which modes of examination that the learning outcomes are assessed.

7. Course evaluation

The course evaluation should be carried out in line with BTH:s course evaluation template and process.

8. Restrictions regarding degree

The course can form part of a degree but not together with another course the content of which completely or partly corresponds with the contents of this course.

9. Course literature and other materials of instruction

• Broman G.: Computational Engineering, Department of Mechanical Engineering, Blekinge Institute of Technology, 2003.

• Ottosen N. S. and Petersson H.: Introduction to the Finite Element Method, Prentice Hall, 1992.

• Lindfield G. and Penny J.: Numerical Methods Using Matlab, Ellis Horwood, 2000.

or later edition.

10. Additional information

This course replaces the course MT2548