Linnæus University

Dnr: 2021/2628-3.1.2.2

Course syllabus

Faculty of Technology

Department of Mathematics

1MA931 Numeriska metoder, 5 högskolepoäng
1MA931 Numerical Methods, 5 credits

Main field of study
Mathematics

Subject Group
Mathematics

Level of classification
First Level

Progression
G1F

Date of Ratification
Approved 2020-06-08
Revised 2021-06-21 by Faculty of Technology.
The course syllabus is valid from spring semester 2022

Prerequisites
1MA901 Linear algebra, 7.5 credits and 1MA465 Multivariable Calculus and Vector Calculus, 7.5 credits or equivalent

Objectives

After completing the course, the student should be able to:
A. *Knowledge and understanding*

- A.1 Explain and distinguish basic concepts and methods in computational mathematics.

B. *Skills and abilities*

- B.1 Identify and use appropriate basic numerical methods to solve and analyze given reality-related problems in the field of technology;
- B.2 demonstrate the ability to combine knowledge of different concepts, methods and numerical algorithms from linear algebra and analysis in problem solving,
- B.3 present in writing and orally computational mathematical reasoning in a structured and logically coherent way, and

- B.4 use the programming language Matlab or equivalent in algorithm implementation, problem solving and visualization.

3. *Judgement and Approach*

- C.1 Demonstrate the ability to assess the relevance and accuracy of numerical calculations,
- C.2 demonstrate the ability to estimate resource needs and compare and evaluate different numerical algorithms and methods for analyzing given technical problems and models;
- C.3 demonstrate the ability to identify the need for additional knowledge and to take responsibility for continuously developing their knowledge and skills.

Content

The aim of the course is to provide concepts and methods in numerical analysis that are important for applications and further studies in computational mathematics and technology. Algorithm implementation, problem solving and visualization using mathematical software is a key element in the course.

- Basic concepts: error analysis, error propagation, conditioning, Richardson extrapolation. Floatning number systems and round off.
- Non-linear equations and linear systems of equations.
- Interpolation.
- Numerical derivation and integration.
- Numerical solution of differential equations: Inital value and boundary value problems, the finite difference method.
- In-depth study and broadening in the form of an assignment in some area of application, such as operational analysis, solid mechanics, heat propagation, data compression and image analysis, signal processing, robotics or financial mathematics.

Type of Instruction

Lectures, teacher-led exercise classes and computer laborations.

Examination

The examination of the course is divided as follows:

Code	Designation	Grade	Credits
2201	Assignment	U/G	1,00
2202	Practical work	U/G	1,00
2203	Written exam	AF	3,00

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade level, the remaining grades follow in descending order where the grade E constitutes the lowest grade level for passing. The grade F means that the student's performance has been assessed as failed.

For a pass grade on the course, the grade G on the part Laboratory assignments and at least the grade E on other parts is required. Hand-in assignments and laboratory assignments are presented in written and oral form. The final grade for the course is

determined by a weighted assessment of the student's performance in the various parts.

Renewed examination is given in accordance with Local rules for course and examination at undergraduate and advanced level at Linnaeus University.

If the university decides that a student is entitled to special educational support due to a disability, the examiner has the right to give an adapted test or that the student completes the test in an alternative way.

Objectives achievement

The examination elements are linked to the course objectives in the following ways:

Goal	2201	2202	2203
A.1			☑
B.1	☑	☑	☑
B.2	☑	☑	☑
B.3	☑	☑	
B.4	☑	☑	
C.1	☑	☑	
C.2	☑		
C.3	☑		

Course Evaluation

During the course or in close connection with the course, course evaluation is carried out. Results and analysis of completed course evaluation will be quickly fed back to the students who have completed the course. Students who participate in the next course occasion will receive feedback at the start of the course. Course evaluation is carried out anonymously.

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: 1MA930 Numerical methods 5 credits, 2MA903 Numerical methods 5 credits,

Required Reading and Additional Study Material

Required reading:

- Sauer, Timothy: Numerical analysis, andra upplagan. Pearson Education, 2013. ISBN: 9781292023588. Approx. 600 pages

Recommended reading:

- Steven J. Leon, Linear Algebra with Applications, latest edition, Pearson.