*Course syllabus*

# Linjär algebra med numeriska tillämpningar
# Linear Algebra with Numerical Applications

## FMAA21, 7,5 credits, G1 (First Cycle)

**Valid for:** 2023/24
**Faculty:** Faculty of Engineering, LTH
**Decided by:** PLED F/Pi
**Date of Decision:** 2023-04-18

## General Information

**Main field:** Technology.
**Compulsory for:** C1
**Language of instruction:** The course will be given in Swedish

## Aim

The aim of the course is to give a basic introduction to linear algebra. A further aim is to give the student a basic ability to use Python to solve common linear algebra problems.

Particular emphasis is put on the role which linear algebra plays in applications in different areas of technology, in order to give the future engineer a good foundation for further studies in mathematics as well as other subjects. The aim is furthermore to develop the students' ability to solve problems and to assimilate mathematical text.

## Learning outcomes

*Knowledge and understanding*
For a passing grade the student must

- with confidence be able to solve linear systems of equations, with or without computer, and be able to demonstrate an ability to geometrically interpret the solutions of such systems.
- be able to represent, handle and compute with - with and without computer - basic geometrical objects in three dimensions, such as points, vectors, lines

and planes.
- be able to show a general knowledge of the matrix concept and of its coupling to the concept of a linear transformation, and be able to carry out elementary matrix operations and to solve matrix equations, with and without computer.
- be able to give an overview of and illustrate mathematical concepts in linear algebra that are used to construct and study mathematical models in applications.
- be able to explain the contents of some central definitions, theorems and proofs.
- be able to account for the method of least squares, and be able to implement it in Python for concrete problems.

*Competences and skills*
For a passing grade the student must

- be able to demonstrate a good ability to carry out algebraic calculations within in the framework of the course.
- in connection with problem solving, be able to demonstrate an ability to independently choose and use mathematical methods within linear algebra.
- in connection with problem solving, be able to demonstrate an ability to integrate concepts from the different parts of the course.
- be able to demonstrate an ability to explain mathematical reasoning in a structured and logically clear way.
- be able to graphically illustrate sets of points in the plane using a computer, and to adapt curves to these.

## Contents

- Systems of linear equations.
- Vectors. Bases and coordinate systems. Equations for lines and planes in space. Scalar product with applications. Vector product with applications.
- Matrices. Rank. Linear transformations. Determinants. Eigenvalues and eigenvectors. The method of least squares. Linear spaces and subspaces.
- Numpy (in Python) as a tool for linear algebra.

## Examination details

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)
**Assessment:** Written exam on Linear Algebra. Computer sessions. The final grade is the grade obtained in the written exam.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

**Parts**
**Code:** 0121. **Name:** Linear Algebra.
**Credits:** 6. **Grading scale:** TH. **Assessment:** Written exam. **Further information:** This is the same exam as for FMA420.
**Code:** 0221. **Name:** Numerical Applications.
**Credits:** 1,5. **Grading scale:** UG. **Assessment:** Oral exam based on the computer experiments during the course.

## Admission

**Assumed prior knowledge:** Basic knowledge in programming - the ability to code and execute simple programs.
**The number of participants is limited to:** No

**The course overlaps following course/s:** FMA420, FMA421, FMA656, FMAB20, FMAA55, FMAA20

## Reading list

- Månsson, J & Nordbeck, P: Linjär algebra. Studentlitteratur, 2019, ISBN: 978-91-44-12740-8.
- Månsson, J & Nordbeck, P: Övningar i Linjär algebra. Studentlitteratur, 2019, ISBN: 978-91-44-13355-3.
- Tutorial for the computer experiments will be provided by the department.

## Contact and other information

**Course coordinator:** Anders Holst, studierektor@math.lth.se
**Course administrator:** Studerandeexpeditionen, expedition@math.lth.se
**Teacher:** Jonas Månsson, Jonas.Mansson@math.lth.se
**Course homepage:** https://canvas.education.lu.se/courses/20440