Course syllabus

Lineär algebra
Linear Algebra

FMAB22, 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: F1, Pi1
Language of instruction: The course will be given in Swedish

Aim

The course is a basic introduction to linear algebra with the aim of giving the future engineer the knowledge and skills that are required for further studies in mathematic, statistics, physics and other quantitative subjects.

Particular emphasis is put on developing the mathematical theory in a systematic manner starting with the axioms for vector spaces, and in this way contributing to the further aims of enhancing the students' ability to assimilate mathematical text, to carry out a mathematical reasoning, to solve problems of both theoretical and applied character, and to communicate mathematics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to describe the solution set of a given system of linear equations in both algebraic and geometric terms.
- be able to represent, handle and perform calculations with basic geometric objects in two and three dimensions, such as vectors, points, lines and planes.
- be able to show a general understanding of the concept of linear map and its connection to the matrix concept, and be able to analyse linear maps through calculations on

matrices.

- be able to demonstrate intimate knowledge of the axioms for general vector spaces, be able to account for the content of some central definitions and theorems, and carry out simple proofs.

Competences and skills
For a passing grade the student must

- demonstrate a good ability to perform algebraic calculations within the framework of the course; both being able to describe algorithms and being able to carry out calculations with pen and paper for examples.
- in the context of solving problems, be able to demonstrate the ability to choose and apply suitable mathematical methods from linear algebra.
- be able to account for a mathematical argument in a structured and logically coherent manner, orally as well as in writing.

Judgement and approach
For a passing grade the student must

- demonstrate understanding of the axiomatic method, and how abstract mathematics can be a powerful tool for solving practical technical problems.
- for a given problem, be able to evaluate and discuss the pros and cons of different conceivable solution methods from linear algebra.
- demonstrate the ability to identify his or her need of further knowledge, also within other areas of mathematics.

Contents

Mathematical induction.

Systems of linear equations and Gaussian elimination.

Geometric vectors in two and three dimensions. Linear independence, bases and coordinate systems. Equations for lines and planes. Conic sections: ellipses, parabolas and hyperbolas. Scalar and vector products with applications.

Matrices and matrix algebra. Matrix inverse and rank. Matrix factorizations such as LU, QR and Cholesky faktorizations.

Abstract vector spaces, bases and coordinates, dimension, subspace. Linear mappings and their representations with matrices, projections, reflections and rotations. Kernel and range for a linear mapping. The Rank-Nullity Theorem.

Inner product spaces, orthogonal complement, orthogonal projections, isometries and orthogonal matrices.The method of least squares with applications.

Determinants. Eigenvalues and eigenvectors. Change of basis and diagonalization. The spectral theorem for symmetric maps on finite dimensional spaces .

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Assignment, written and oral presentation of the solution to a problem that the student has been given in advance. Written examination comprising theory and problems. The student must have passed on the assignment in order to be eligible to take part in the examination.

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: 0123. **Name:** Linear Algebra.
Credits: 7,5. **Grading scale:** TH. **Assessment:** Written examination comprising theory and problems. **Further information:** The student must have passed on the assignment (oral and in writing) in order to take the written examination.

Code: 0223. **Name:** Assignment.
Credits: 0. **Grading scale:** UG. **Contents:** When the assignment is examined the student must bring a written solution to a previously distributed problem connected with the course contents. He or she must be able to orally account for the solution, and answer questions about it. **Further information:** Apart from the scheduled session to pass on the assignment there are a few extra chances, for those who need them, to pass before the written examination on the course.

Admission

The number of participants is limited to: No
The course overlaps following course/s: FMAA20, FMAA21, FMAB20, MATA22, FMA420

Reading list

• K.G.Andersson: Lineär algebra. Studentlitteratur, 2000, ISBN: 978-91-44-01608-5. Second edition.

Contact and other information

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