SF1672 Linear Algebra 7.5 credits

Linjär algebra

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SF1672 valid from Autumn 2016

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Basic and specific requirements for engineering program.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course students should for a passing grade be able to

- use the basic concepts and problem solving methods in linear algebra and geometry. In particular it means to be able to:
  - understand, interpret and use the basic concepts: the vector space R^n, subspaces of R^n, linear dependence and independence, basis, dimension, linear transformations, matrix, determinant, eigenvalue and eigenvector.
  - solve geometric problems in two and three dimensions using for example vectors, dot product, vector product, triple product and projection.
  - use Gauss-Jordan's method for example to solve linear systems of equations, calculate inverse matrices, determinants and to resolve questions about linearly independent.
  - use matrix and determinant calculus to address issues regarding linear transformations and linear systems.
  - use the least-squares method to solve for example problems with over-determined linear systems of equations.
  - use different bases for vector spaces to handle vectors and linear transformations, and to manage changes of bases and linear coordinate transformations.
  - compute eigenvalues and eigenvectors and use this for example in order to diagonalize matrices, to study quadratic forms, conics in the plane and quadratic surfaces in three space.
  - use the Euclidean inner product in order to address the questions about distance, orthogonality and projection, and apply Gram-Schmidt's method to calculate orthogonal bases of subspaces.
- set up simple mathematical models where the fundamental concepts in linear algebra and geometry are used, discuss the relevance of such models, reasonableness and accuracy, and know how mathematical software can be used for calculations and visualization.
- read and understand mathematical texts about for example, vectors, matrices, linear transformations and their applications, communicate mathematical reasoning and calculations in this area, orally and in writing in such a way that they are easy to follow.
- use Matlab for computation and visualization of applied mathematical problems in linear algebra.

For higher grades, the student in addition should be able to:

- manage general vector spaces, such as function spaces or vector spaces of matrices.
- use other inner products than the Euclidean inner product.
- derive important relations in linear algebra and geometry.
- generalize and adapt the methods to use in somewhat new contexts.
- solve problems that require synthesis of material and ideas from all over the course.
- describe the theory behind concepts such as eigenvalues and orthogonality.

Course contents

Vectors, matrices, linear equations, Gaussian elimination, vector geometry with dot product and vector product, determinants, vector spaces, linear independence, bases, change of

basis, the least-squares method, eigenvalues, eigenvectors, quadratic forms, orthogonality, inner-product space, Gram-Schmidt's method. Programming and visualization in Matlab.

Course literature

The literature is published on the course webpage no later than four weeks before the course starts.

Examination

- LAB1 - Laboratory Sessions, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Written exam (TEN1; 6 hp).

Computer assignments (LABA; 1,5 hp).

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.