Linear Algebra, Honours Course

Programme course

6 credits

Linjär algebra, överkurs

TATA53

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Mathematics, Applied Mathematics

Course level
First cycle

Advancement level
G2X

Course offered for
- Biomedical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Mathematics
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
A basic course in linear algebra.

Intended learning outcomes

This course extends the first course in linear algebra so that the student will be prepared for advanced courses in mathematics and applied subjects. After completing the course the student will be able to

- describe basic concepts and properties of complex vector spaces
- use and prove the spectral theorem for Hermitian and normal maps
- use the singular value decomposition in applications
- use the theory of positive matrices in applications
- determine and apply the Jordan canonical form
- use linear algebra in solving systems of differential and difference equations

Course content

Complex vector spaces. Norms and scalar products. Direct sum. Matrix factorizations: LU, Cholesky, QR. Schur factorization. The spectral theorem for Hermitian and normal maps. The singular value decomposition with applications. Low-rank approximation, pseudoinverse, least square problems, polar factorization. The Cayley-Hamilton theorem. Invariant subspaces. Generalized eigenvectors. The Jordan normal form. Applications to systems of differential and difference equations. Positive matrices. The Perron and Frobenius theorems. Applications to ranking models. Introduction to multilinear algebra. Dual spaces, tensors, tensor product, Kronecker product.

Teaching and working methods

Lectures and assigned problems to be handed in.
The course runs over the entire spring semester.

Examination

UPG1	Hand-in exercises	6 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Matematiska institutionen

Director of Studies or equivalent

Jesper Thorén

Examiner
Göran Bergqvist

Course website and other links
http://www.mai.liu.se/und/kurser/index-amne-tm.html

Education components
Preliminary scheduled hours: 38 h
Recommended self-study hours: 122 h

Course literature
Treil, S: Linear Algebra Done Wrong

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.