GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2023-2024

Linear Algebra and Geometry (C001094)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 2)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2023-2024

De Medts, Tom	WE01	lecturer-in-charge

Offered in the following programmes in 2023-2024	**crdts**	**offering**
Bachelor of Science in Computer Science	6	A

Teaching languages

Dutch

Keywords

First degree equations, systems of linear equations, matrices, determinants, vector spaces, linear maps, eigenvalues and eigenvectors, inner product spaces and Euclidean spaces.

Position of the course

Linear algebra provides a basis for on the one side numerical applications (solving numerically systems of equations, eigenvalue problems), and on the other side applications of linear structures in computer science and communication technology. Concepts from linear algebra are closely connected to (Euclidean) geometry. One obtains a better intuition by connecting the algebra directly to the geometry.

Contents

1 First degree equations and matrices (Gauss elimination, echelon form, computing with matrices, invertibility, elementary row operations and elementary matrices)
2 Determinants (definition, existence, properties)
3 Vector spaces (subspaces, linear combinations, sum and direct sum, linear independence, basis, dimension)
4 Linear maps and linear operators (matrix representation, base change, dimension theorem, rank, linear problems)
5 Eigenvalues, eigenvectors and diagonalizability (definition, applications, Google PageRank)
6 Inner product spaces and Eculidean spaces (Euclidean geometry, orthogonality, projections)

Initial competences

Being able to work with algebraic structures: groups, fields and polynomial rings as introduced in the course: Discrete mathematics.

Final competences

1 Insight in linear problems.
2 Being able to apply the techniques to solve linear problems (solving linear systems over different fields.)
3 Being able to use methods and algorithms from computer algebra.
4 Recognizing eigenvalue problems and being able to solve them.
5 Explaining the connections between theoretical concepts and applications of

different nature.
6 Analyzing geometric transformations of the plane and of 3-dimensional space.
7 Being able to interpret algebraic concepts geometrically and vice versa.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Extra information on the teaching methods

Lectures: surveying and discussing the material.
Exercise sessions: Problems and methods to solve them are explained. Practicing techniques to solve problems. Learning to use the computer programs. Special sessions during which the students work out problems that are corrected and commented afterwards.

Learning materials and price

The students are expected to buy a copy of the book "Linear Algebra" (Paul Igodt & Wim Veys). This includes access to the online exercise platform usolv-it.

References

Lineaire Algebra, Paul Igodt & Wim Veys, 3e edition, Universitaire Pers Leuven, 2022. (First edition 2011.)

Course content-related study coaching

Interactive support via Ufora. The teacher is always prepared to give additional explanation at any time.

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment open-book

Examination methods in case of periodic assessment during the second examination period

Written assessment open-book

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

The written exam is "open book" and consists of 3 parts:
(1) Theory: commenting on and explaining arguments, proofs, notions, ...
(2) True/false questions: Theoretical questions probing the insight in the material and the ability to make connections.
(3) Exercises: Problems on lineair algebra and geometry.

Calculation of the examination mark

Marks per part: 30% - 30% - 40%.

Facilities for Working Students

Work students can choose to get an alternative task, if they wish, in place of a fixed period examination, so that they have the possibility to spread this over a larger period of time.