Database Systems

2025 - 2026

Is part of the next programmes:

- M0012004 Master of Computer Science: Software Engineering

- M0012005 Master of Computer Science: Data Science and Artificial Intelligence

- M0012006 Master of Computer Science: Computer Networks

- M0048004 Master of Computer Science: Software Engineering

- M0048005 Master of Computer Science: Data Science and Artificial Intelligence

- M0048006 Master of Computer Science: Computer Networks

- M0090004 Master of Teaching in Science and Technology: Computer Science

- M0119000 Master of Digital Business Engineering

- M0119000 Master of Digital Business Engineering

- U0001008 Courses open to exchange students in Sciences

Course Code:	2002WETGDS
Study Domain:	Computer Science

Semester:	1E SEM
Contact Hours:	45
Credits:	6
Study Load (hours):	168
Contract Restrictions:	No contract restriction
Language of Instructions:	ENG
Lecturer(s):	T Floris Geerts
Examperiod:	exam in the 1st semester

1. Prerequisites *

speaking and writing of:

- English

general notion of the basic concepts of

Algorithms and Data structures

specific prerequisites for this course

Basic knowledge of databases and SQL

2. Learning outcomes *

- You have insight in the inner workings of database systems
- You know how data is internally represented and how queries are efficiently evaluated

- You are familiar with various algorithms that make the querying of large amounts of data feasible

- You understand why certain design choices are made in the development of database systems and how these choices affect the performance of database systems

3. Course contents *

In today's digital society, database systems play an important role. Such systems ensure that large quantities of data can be efficiently manipulated and queried. In this course we look at the inner workings of such systems. Efficient algorithms for storing, indexing and querying of data form the backbone of this course. More specifically, the following topics will be considered in the database systems course:

- The relational model and SQL
- Storage en Indexing
  - Hash-based indexing (Linear, Extendible)
  - Tree-based indexing (B+tree, ISAM)
- External Sorting
  - External merge sort
  - B+ tree sorting
- Buffer management
  - Buffer replacement policies
  - I/O
- Query evaluation
  - Query optimization
  - Join algorithms
  - Cardinality estimation
  - Query plans
- Transaction Management
  - ACID
  - Serializability
  - Two phase locking
  - Concurrency control
- Crash Recovery
  - Checkpoints
  - ARIES

4. International dimension *

- This course stimulates international and intercultural competences.

- Students use course materials in a foreign language.

5. Teaching method and planned learning activities

5.1 Used teaching methods *

Class contact teaching

- Lectures

Personal work

- Exercises

5.2 Planned learning activities and teaching methods

The course consists of 12 lectures, structured as follows:

lecture 1 Introduction
lecture 2 Storage
lecture 3 Indexing
lecture 4 Tree-structured indexing
lecture 5 Multi-dimensional indexing
lecture 6 Hash-based indexing
lecture 7 External sorting
lecture 8 Evaluation of relational operators
lecture 9 Selectivity estimation
lecture 10 Query optimization
lecture 11 Transaction management
lecture 12 Recovery

5.3 Facilities for working students *

Classroom activities

- Lectures: recording available via video link on Blackboard

6. Assessment method and criteria *

6.1 Used assessment methods *

Examination

- Written examination without oral presentation

6.2 Assessment criteria *

The following assessment criteria are applicable to this course:
- The understanding of the inner workings of database systems;
- The analysis of the methods seen in class in a variety of scenarios; and
- The design of efficient algorithms for large quantities of data.

A written exam determines the grade of this course. Previous exams (with solutions) will be made available.

7. Study material

7.1 Required reading *

Slides are made available through blackboard. Printed versions are also available at the "cursusdienst" (Universitas)

7.2 Optional reading

The following study material can be studied voluntarily :

Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke.   Graw-Hill Education; third edition.

8. Contact information *

Floris Geerts is available for questions and comment in G103B (only after appointment by email: floris.geerts@uantwerpen.be)

9. Tutoring

The course consists of many algorithmic methods. To gain a better understanding of these methods, it is advised to make exercises. Exercises will be made available but the recommended textbook consists a plenitude of exercises as well.