

CS-322

**Introduction to database systems**

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<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Communication systems	BA6	Opt.
Computer science minor	E	Opt.
Computer science	BA6	Obl.
Data science minor	E	Opt.
Energy Management and Sustainability	MA2, MA4	Opt.
Environmental Sciences and Engineering	MA2, MA4	Opt.
HES - IN	E	Obl.
HES -SC	E	Obl.
Mineur STAS Russie	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	2 weekly
Exercises	1 weekly
Project	1 weekly
<b>Number of positions</b>	

**Summary**

This course provides a deep understanding of the concepts behind data management systems. It covers fundamental data management topics such as system architecture, data models, query processing and optimization, database design, storage organization, and transaction management.

**Content**

This course provides a deep understanding of the concepts behind data management systems.

**During this course, the students will learn about:**

- The Entity-relationship and Relational Models
- Relational Algebra and Calculus
- The SQL Query Language
- Traditional and Modern Data Storage, File Organizations, and Indexing
- Hashing and Sorting
- Query Evaluation and Relational Operators
- Query Optimization
- Schema Refinement
- Transaction Management (Concurrency Control and Recovery)

**Homework**

Homeworks will be assigned to aid and assess comprehension of the above material. Homework will be either done using pen and paper or they will be programming exercises. During the semester the students will be asked to do a project to gain experience on how to build a database application, and to apply what they learn in class.

**Keywords**

databases, database design, data modeling, normalization, database management systems (DBMS), files, indexes, storage, external sorting, queries, query evaluation, query optimization, transactions, concurrency, recovery, SQL

**Learning Prerequisites****Required courses**

Data structures

**Recommended courses**

For the practical part of the course (project) the following skills will be needed:

- System oriented programming, with focus on scripting languages to enhance the parsing process of raw data.
- Building user interfaces, either web (e.g., PHP, JSP, ASP, ...) or application GUI (e.g., java).

### **Important concepts to start the course**

Before the beginning of the course students must be familiar with:

- Data structures
- Algorithms concepts

### **Learning Outcomes**

By the end of the course, the student must be able to:

- Express application information requirements
- Use a relational DBMS
- Create a database on a relational DBMS
- Design a database with a practical application in mind
- Model the data of an application using ER and relational modeling
- Explore how a DBMS performs its work
- Report performance and possible optimizations for applications using DBMS
- Justify design and implementation choices

### **Transversal skills**

- Assess progress against the plan, and adapt the plan as appropriate.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Write a scientific or technical report.
- Make an oral presentation.

### **Teaching methods**

Ex cathedra; including exercises in class, practice with pen and paper or with a computer, and a project

### **Expected student activities**

During the semester, the students are expected to:

- attend the lectures in order to ask questions and interact with the professor,
- attend the exercises session to solve and discuss exercises about the recently taught material,
- work on a project during the semester which covers the practical side of building an application using a database system,
- take a midterm
- take a final exam

### **Assessment methods**

Homework, project, written examinations and continuous control.

### **Resources**

### **Bibliography**

Slides, list of books, additional material (research articles), all indicated and/or available on moodle page.

### **Ressources en bibliothèque**

- [Database Management Systems / Ramakrishnan](#)

### **Notes/Handbook**

The slides that are used in the class are available for the students.