

Databases

Course Coordinator NOM / Prénom: SENELLART Pierre

Course Coordinator Affiliation: ENS-PSL

Course Coordinator webpage: <https://pierre.senellart.com/>

Other Instructor(s) NOM / Prénom: STANZIONE Roberto

Other Instructor(s) Affiliation: Inria

Learning Objectives :

- Model structured data using the relational model, including the design of schemas, keys, and integrity constraints.
- Formulate and analyze queries using relational algebra and SQL, and understand their expressive power.
- Understand factors affecting database performance and correctness, including indexing, query optimization, and transactions.
- Implement database-backed applications in Python, using SQL and a simple ORM within a basic web application.
- Understand the role of databases in data-driven and AI systems.

Course Description : The course will cover the following topics, roughly in that order of progression:

- Introduction to data management and the relational model.
- Relational algebra and basics of SQL.
- Advanced SQL.
- Database design and normalization.
- First-order logic, the relational calculus, and Codd's theorem.
- Indexing and storage.
- Query evaluation and query optimization.
- Transactions and concurrency.
- SQL databases and Python programming.
- Basics of Web programming, on the client side.
- Basics of Web programming, on the server side.
- SQL for the Web.
- SQL databases vs in-memory storage with Pandas for AI applications.

Language of Instruction: English.

Course Format: Lectures + Tutorials / Lab sessions.

Total number of hours for the semester: 22.5 hours of Lectures and 22.5 hours of Tutorials.

Assessment Methods: 20% of the grade on weekly quizzes. 80% of the grade on the final exam.

Level: Bachelor

Semester: Semester 2

Required Readings: No required readings beyond the standard course material.

Recommended Readings:

- *Database Systems: The Complete Book*, 2nd Edition. Hector Garcia-Molina, Jeffrey Ullman, Jennifer Widom. Pearson, 2008. Classical textbook on databases, strongly recommended.
- *Database System Concepts*, 7th edition. Abraham Silberschatz, Henry F. Korth, S. Sudarshan. McGraw Hill, 2019. Very good textbook, more recently updated.
- *Learning Python: Powerful Object-Oriented Programming*, 6th edition. Marc Lutz. O'Reilly Media, 2025. Python programming textbook.

