Co-funded by the European Union

EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

DATABASE SYSTEMS

Organised by

Poznan University of Technology

1. IDENTIFYING DATA.	
· Course Name.	Database Systems
· Coordinating University.	Poznan University of Technology
· Partner Universities Involved.	
· Course Field(s).	Computer Science; Information Technology; Software Engineering; Data Engineering.
· Related Study Programme.	Bachelor programmes in: Computer Science, Artificial Intelligence, Software Engineering, ICT-related programmes.
· ISCED Code.	0613 – Software and applications development and analysis
· SDG.	SDG 4 – Quality Education; SDG 8 – Decent Work and Economic Growth; SDG 9 – Industry, Innovation and Infrastructure; SDG 16 – Peace, Justice and Strong Institutions (data integrity/secure systems).
· Study Level.	B, open to Bachelor students
· EUNICE Key Competencies	[Indicate the Key Competencies offered by the course.] • Green – strongly • Orange - moderately • Red – partially • Blank cell - not at all

Problem solving	
Teamworking	
Communication	

	Self-management	
	Cognitive flexibility	
	Digital competence	
	Technical competence	
	Global intercultural competence	

· Number of ECTS credits allocated.	5.0 (Classes that require direct contact with the lecturer - 2.5)
· Mode of Delivery.	Online live
· Language of Instruction.	English
· Course Dates.	Winter semester 2026/2027
· Precise Schedule of the Lectures.	15 weeks, 2 hours/week lecture 2 hours/week practical/lab, synchronous online delivery.
· Key Words.	database design, SQL, PostgreSQL, normalization, indexing, transactions, APIs, data modeling, CRUD systems, optimization
· Catchy Phrase.	Learn how modern applications store, process and scale data - from schema design to deployment.

· Prerequisites and co-requisites.	basic programming knowledge; elementary algorithmic thinking; English level: B2 minimum; this course is available for B.
· Number of EUNICE students that can attend the Course.	30

· Number of EUNICE students that can attend the course per institution	2-4 guaranteed places per institution (flexible).
· Course inscription procedure(s).	Standard EUNICE process.

2. CONTACT DETAILS.	
· Department.	Faculty of Computing and Telecommunications
· Name of Lecturer.	Dr. Serhii Baraban
· E-mail.	serhii.baraban@put.poznan.pl
· Other Lecturers.	

3. COURSE CONTENT.

This course introduces students to the principles and practice of modern database systems. Topics include relational data modeling, SQL querying, normalization, indexing strategies, transactions, concurrency control, and performance optimization. Students will design and implement real-world database-backed applications using PostgreSQL and connect databases with modern software stacks such.
Practical work focuses on transforming business requirements into scalable and efficient data architectures.
Link to the local course: https://ekursy.put.poznan.pl/course/view.php?id=3357

4. LEARNING OUTCOMES.

After completing the course, students will be able to:
Knowledge:
demonstrate structured theoretical knowledge in database systems;
understand principles of database design and implementation;
understand software engineering aspects related to database systems;
know basic methods, techniques, and tools used in solving database-related problems.
Skills:
design and implement a simple information system according to given specifications;
evaluate correctness and effectiveness of database system operation;
perform basic performance testing of database solutions;
build database-driven systems using at least one popular DBMS;
develop and implement data processing algorithms using modern tools.
Competences:
recognize the need for continuous learning due to rapid evolution of database technologies;

understand causes and consequences of poorly designed information systems, including technical, financial, and social impacts; critically assess database solutions from engineering and societal perspectives.

5. OBJECTIVES.

The course aims to:
1) provide theoretical foundations of database systems;
2) develop practical skills in relational database design and implementation;
3) introduce modern database management tools and engineering practices;
4) enable students to build and test database-backed applications;
5) foster analytical thinking in evaluating database performance and correctness;
6) develop awareness of technological change and responsibility in information system design.

6. COURSE ORGANISATION.

UNITS

1.	Introduction to databases systems.
2.	Data Models.
3.	The relational database model.
4.	Entity-Relationship (ER) Modeling.
5.	Advanced data modeling.
6.	Normalization of database tables.
7.	Introduction to SQL.
8.	Advanced SQL.
9.	Database design.
10.	Transaction management and concurrency control.
11.	Database performance tuning and query optimization.
12.	Object-based and object-oriented databases.
13.	Object-Relational Mapping (ORM).
14.	Big Data.
15.	NoSQL databases.

LEARNING RESOURCES AND TOOLS.

https://www.postgresql.org.pl/
https://www.pgadmin.org/
https://github.com/
https://dbeaver.io/
https://www.w3schools.com/sql/
https://hostingdata.co.uk/nosql-database/?fbclid=IwAR356t2F5ctDBjl7-LxINina3U4cbHTMpsiG7CQNpmDVrQb6W1mFcCGpEi4
https://flask.palletsprojects.com/en/stable/
https://www.mongodb.com/developer/languages/python/farm-stack-fastapi-react-mongodb/
PostgreSQL
pgAdmin
FastAPI/Flask
GitHub Classroom
SQL
DBeaver
MongoDB

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.

Lectures,
guided labs,
individual exercises,
team mini-project,
presentations,
consultations.

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.

Suggested:
Lab assignments - 30%
Practical exam - 20%
Database design project - 40%
Participation - 10%
Graded course

OBSERVATIONS.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.

1. PostgreSQL Global Development Group. PostgreSQL 18 Documentation. 2026. Available at: https://www.postgresql.org/docs/18/index.html (accessed 3 May 2026).

2. W3Schools. SQL Tutorial: Learn SQL. Online educational resource, 2026. Available at: https://www.w3schools.com/sql/ (accessed 3 May 2026).
3. Huawei Technologies Co., Ltd. “Database Design Fundamentals.” In: Data Storage Principles and Technologies. Springer, 2022. Available at: https://link.springer.com/chapter/10.1007/978-981-19-3032-4_7 (accessed 3 May 2026).
4. Pavlo, A. Lecture #02: Modern SQL. CMU 15-445/645, Fall 2024. Available at: https://15445.courses.cs.cmu.edu/fall2024/notes/02-modernsql.pdf (accessed 3 May 2026).
5. Patel, J. Lecture Notes: Database Storage, Part I. CMU 15-445/645, Spring 2024. Available at: https://15445.courses.cs.cmu.edu/spring2024/notes/03-storage1.pdf (accessed 3 May 2026).
6. UC Berkeley. CS186: Introduction to Database Systems, Fall 2024 / Spring 2025 Notes. Available at: https://cs186berkeley.net/fa24/ (accessed 3 May 2026).
7. OpenStax. Foundations of Information Systems: Practical Applications of Database Design and Management. 2025. Available at: https://openstax.org/books/foundations-information-systems/pages/3-2-practical-applications-of-database-design-and-management (accessed 3 May 2026).
8. freeCodeCamp. How to Design Structured Database Systems Using SQL. 2025. Available at: https://www.freecodecamp.org/news/how-to-design-structured-database-systems-using-sql-full-book/ (accessed 3 May 2026).
9. FastAPI Documentation. SQL Relational Databases. 2025/2026. Available at: https://fastapi.tiangolo.com/tutorial/sql-databases/ (accessed 3 May 2026).
10. Khan, W.; Kumar, T.; Zhang, C.; Raj, K.; Roy, A.M.; Luo, B. SQL and NoSQL Database Software Architecture Performance Analysis and Assessments - A Systematic Literature Review. Big Data and Cognitive Computing, 2023, 7(2), 97. Available online: https://www.mdpi.com/2504-2289/7/2/97 (accessed 3 May 2026).
11. Tripathi, N.; et al. NoSQL Database Education: A Review of Models, Tools and Curriculum Development. Journal of Systems and Software, 2025. Available online: https://www.sciencedirect.com/science/article/pii/S0164121225000597 (accessed 3 May 2026).
12. Hu, V. C.; Ferraiolo, D.; Kuhn, R.; Chandramouli, R. Access Control on NoSQL Databases. NIST Internal Report 8504, National Institute of Standards and Technology, 2024. Available online: https://nvlpubs.nist.gov/nistpubs/ir/2024/NIST.IR.8504.pdf (accessed 3 May 2026).