



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus
2025 - 2026

GENERAL INFORMATION

Data of the subject	
Subject name	Databases
Subject code	DTC-IMAT-222
Main program	Bachelor's Degree in Mathematical Engineering and Artificial Intelligence
Involved programs	Grado en Ingeniería Matemática e Inteligencia Artificial [Second year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	7,5 ECTS
Type	Obligatoria (Grado)
Department	Department of Telematics and Computer Sciences

Teacher Information	
Teacher	
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites
Python programming
Basic computer skills.
Algebra (set theory)



Course contents

Contents

The course content is divided into 6 topics: introduction to databases, relational databases, introduction to non-relational databases, document databases (MongoDB), graph-based and memory-based databases and finally, introduction to cloud databases.

Block 1. Introduction to databases

Introduction to databases

Structured vs. unstructured information.
Data recovery and ingestion. Acquisition, Ingest, ETL.
Introduction to databases. Types of databases.
Data architectures: data lakes, data warehouse, data marts.

Block 2. Relational databases

Relational databases

Introduction to the entity-relationship model, relational model (design) and normalisation.
Relational databases.

Database management, SQL, relational algebra and calculus.
Query optimisation and benchmarking.

Block 3. Introduction to non-relational databases (noSQL)

Introduction to non-relational databases (noSQL)

Non-relational (noSQL) database types

Scalability

Block 4. Document databases. MongoDB

Document databases. MongoDB

MongoDB. Characteristics, use and management.
CRUD. Queries. Operators.
Indexes and benchmarking

Block 5. Graph based and memory based databases

Graph and memory based databases

Introduction to Neo4J.
Basic Neo4J queries and functions
Introduction to Redis.



Block 6. Introduction to cloud databases

Introduction to cloud databases

Introduction and examples of cloud databases

EVALUATION AND CRITERIA

The use of AI to produce full assignments or substantial parts thereof, without proper citation of the source or tool used, or without explicit permission in the assignment instructions, will be considered plagiarism and therefore subject to the University's General Regulations.

Evaluation activities	Evaluation criteria	Weight
• Partial exam: 20% • Final: 50%	Partial exam (20%): exam oriented to understand the theoretical concepts of databases, including data architectures, the different types of structured, unstructured and semi-structured data, relational databases, including relational model (and relational database design), relational algebra and calculus, SQL (queries) and some definitions of non-relational databases (if time permits). Final exam (50%): exam containing the same content of the intermestral exam and extending it with additional concepts (and queries) related to non-relational databases. NO AI: The assessment is completed entirely without AI assistance in a controlled environment, ensuring that students rely solely on their existing knowledge, understanding, and skills. You must not use AI at any point during the assessment. You must demonstrate your core skills and knowledge. Any student who uses it will receive a Fail (0) on that test and a disciplinary procedure will be initiated in accordance with the University's General Regulations.	70 %
	Weekly assignments (15%): In addition to the functionality and the results obtained, the code style used in the assignments and the quality of the reports	



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Weekly assignments 15%	requested will be assessed. AI COLLABORATION (only free URLs): AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding. You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use. Inappropriate use of AI tools may affect the overall evaluation of submitted assignments. Likewise, faculty members reserve the right to question students about specific aspects of their work to verify their understanding; the outcome of these consultations may also influence the final evaluation of the corresponding assignments. Students must clearly document in their submissions the specific tasks for which they have used AI tools. This does not exempt the student from responsibility for the submitted content, nor from the possibility of being questioned about it.	15 %
Final project 15%	Final project (15%): Project containing the use of different types of databases explored in the course. In addition to the functionality, the design used in the project and the application of the course contents will be evaluated. AI COLLABORATION (only free URLs): AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding. You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use.	15 %



Inappropriate use of AI tools may affect the overall evaluation of submitted assignments. Likewise, faculty members reserve the right to question students about specific aspects of their work to verify their understanding; the outcome of these consultations may also influence the final evaluation of the corresponding assignments.

Students must clearly document in their submissions the specific tasks for which they have used AI tools. This does not exempt the student from responsibility for the submitted content, nor from the possibility of being questioned about it.

Grading

There will be 2 calls. Ordinary call in May and the extraordinary call in June.

Ordinary call

The grade for the ordinary call (CO) will be as follows:

- 50% for the final exam (EX_F).
- 20% for the inter-semester exam (EX_I)
- 15% the project (PROY)
- 15% for the weekly assignments (PRACT).

In other words:

$$CO = 0.5 * EX_F + 0.2 * EX_I + 0.15 * PROY + 0.15 * PRACT$$

$CO \geq 5$ will be required to pass the course and the following restrictions must be met:

- It will be mandatory that $EX_F \geq 5$. That is to say, the grade of the final exam of the subject must be equal to or higher than 5. Otherwise, $CO = EX_F$.
- It is compulsory that $(PROY + PRACT) / 2 \geq 5$. That is, a mark greater than or equal to 5 must be obtained in the average obtained between the project and the weekly assignments in order to pass the course. If this minimum grade is not reached in the ordinary call, both the project and the assignments can be handed in again in the extraordinary call and $CO = (PROY + PRACT) / 2$. The grade of the exam in the ordinary exam will be kept for the extraordinary exam if it is passed.
- It will be necessary to obtain a grade of at least 4 in both the project and the assignments in order to pass the course. In other words, $PROY \geq 4$ and $PRACT \geq 4$. If this restriction is not met, $CO = \min(PRACT, PROY)$. The grade for the exam in the ordinary call is saved for the extraordinary exam call if the student passes. If $PROY \geq 4$ and $PRACT \geq 4$ are met, the grades of PROY and PRACT are saved for the extraordinary exam, provided that $(PROY + PRACT) / 2 \geq 5$. If the condition of $PROY \geq 4$ and $PRACT \geq 4$ is not met, the project and/or the assignments can be handed in again in the extraordinary call.

GENERAL RULES:

- If the student fails to attend 15% or more of the classroom hours of this subject, the student will not be allowed to take the final



exam in both the ordinary and extraordinary calls.

- The lab assignments/project handed in 24h after the deadline will have a penalty of 50% of the grade. After 24h after the deadline, the grade of the lab assignments/project will be 0.

Extraordinary call

The grade for the Extraordinary call (EC) will be as follows:

- 70% for the final exam of the course (EX_F, the inter-semester exam is not taken into account).
- 15% for the project (PROY)
- 15% for the weekly assignments (PRACT).

In other words:

$$CE = 0.7 * EX_F + 0.15 * PROJ + 0.15 * PRACT$$

$CE \geq 5$ will be necessary to pass the course and the following restrictions must be met:

- It will be mandatory that $EX_F \geq 5$. That is to say, the mark of the final exam of the subject must be equal to or higher than 5. Otherwise, $CE = EX_F$.
- It is compulsory that $(PROY + PRACT) / 2 \geq 5$. That is, a mark greater than or equal to 5 must be obtained in the average obtained between the project and the weekly assignments. If this minimum grade is not reached, then $CE = (PROY + PRACT) / 2$.
- It will be necessary to obtain a grade of at least 4 in both the project and the assignments in order to pass the course. In other words, $PROY \geq 4$ and $PRACT \geq 4$. If this condition is not met, $CE = \min(PRACT, PROJ)$.

GENERAL RULES:

- If the student fails to attend 15% or more of the classroom hours of this subject, the student will not be allowed to take the final exam in both the ordinary and extraordinary calls.
- The lab assignments/project handed in 24h after the deadline will have a penalty of 50% of the grade. After 24h after the deadline, the grade of the lab assignments/project will be 0.

WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Reading and study of the theoretical contents, notes and code provided by the teacher.	After and before each class	
Final project.	The material will be available right before easter	Before the final exams
Exams	March, May, June	
Weekly assignments	Before, during and after the assignment class	Approximately 1 week after publication in moodle



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Block 1: Introduction to databases	At the start of the course	1 week approximately
Block 2: Relational Databases	After Block 1. January	Approximately 4,5 weeks
Block 3. Introduction to non-relational databases (noSQL).	After Block 2. February	Approximately 1,5 weeks
Block 4 : Documental databases	After Block 3. March	Approximately 2 weeks
Block 5: Graph-based and in-memory databases	After block 4. At the end of march and start of april	Approximately 2 weeks
Block 6: Introduction to cloud databases and final exercises	After block 5. April	Until the end of the course

BIBLIOGRAPHY AND RESOURCES

Basic References

Moodle (manuals, slides and professor's exercises)

Contact the professor to supplement the course materials with reference books.

In compliance with current regulations on the **protection of personal data**, we would like to inform you that you may consult the aspects related to privacy and data [that you have accepted on your registration form](#) by entering this website and clicking on "download"

[https://servicios.upcomillas.es/sedelectronica/inicio.aspx?csv=02E4557CAA66F4A81663AD10CED66792](https://servicios.upcomillas.es/sedeelectronica/inicio.aspx?csv=02E4557CAA66F4A81663AD10CED66792)