Syllabus
2023 - 2024

GENERAL INFORMATION

Data of the subject	
Subject name	Databases
Subject code	DTC-IMAT-222
Mainprogram	Grado en Ingeniería Matemática e Inteligencia Artificial
Involved programs	Grado en Ingeniería Matemática e Inteligencia Artificial [Second year]
Credits	7,5 ECTS
Type	Obligatoria (Grado)
Department	Department of Telematics and Computer Sciencies

Teacher Information	
Teacher	
Name	Israel Alonso Martínez
Department	Department of Telematics and Computer Sciencies
Office	Alberto Aguilera 25
EMail	ialonso@icai.comillas.edu
Phone	4267
Teacher	
Name	Pablo Sánchez Pérez
Department	Department of Telematics and Computer Sciencies
EMail	psperez@icai.comillas.edu
Profesores de laboratorio	
Teacher	
Name	María Elena García García
Department	Department of Telematics and Computer Sciencies
EMail	megarcia@icai.comillas.edu

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 main topics: Introduction to databases, Relational databases, Introduction to non-relational databases, Document databases (MongoDB), Graph-based and Memory-based databases and finally, Cloud databases.

Block 1. Introduction to databases

Introduction to databases

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

Block 2. Relational databases

Relational databases

Introduction to the entity-relationship model, relational and normalisation.
Relational databases. SQL
Relational algebra and calculus.
Query optimisation and benchmarking.

Block 3. Introduction to non-relational databases

Introduction to non-relational databases

Non-relational 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. Cloud databases

Cloud databases

Use case examples. Relational and non-relational Cloud Services.
Visualisation services in the cloud.
Data architectures.

EVALUATION AND CRITERIA

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. **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.	70 %
Weekly assigments 15%	**Weekly assigments (15%):** In addition to the functionality and the results obtained, the code style used in the assigments and the quality of the reports requested will be assessed.	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.	15 %

Grading

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

Ordinary call

he 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 ≥ 5 will be required to pass the course and the following restrictions must be met:

- It will be mandatory that EX_F ≥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 ≥ 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 exam 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 average of the assignments in order to pass the course. In other words, PROY ≥ 4 and PRACT ≥ 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 ≥ 4 and PRACT ≥ 4 are met, the grades of PROY and PRACT are saved for the extraordinary exam.

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 ≥ 5 will be necessary to pass the course and the following restrictions must be met:

- It will be mandatory that EX_F ≥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 ≥ 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 average of the assignments in order to pass the course. In other words, PROY ≥ 4 and PRACT ≥ 4. If this condition is not met, CE = MIN(PRACT, PROY).

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.

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	During the final exams
Exams	March, May, June	
Weekly assignments	Before, during and after the assignment class	Approximately 1 week after publication in moodle
Block 1: Introduction to databases	At the start of the course	1 week
Block 2: Relational Databases	After Block 1. January	Approximately 4 weeks
Block 3. Introduction to non-relational databases.	After Block 2. February	Approximately 2 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: cloud databases	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.