COURSE DATA

Data Subject	
Code	34675
Name	Database management
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1400 - Degree in Computer Engineering	School of Engineering	3	First term
1407 - Degree in Multimedia Engineering	School of Engineering	4	First term

Subject-matter

Degree	Subject-matter	Character
1400 - Degree in Computer Engineering	13 - Information systems and intelligent systems	Obligatory
1407 - Degree in Multimedia Engineering	19 - Optatividad	Optional

Coordination

Name	Department
CERVERON LLEO, VICENTE	240 - Computer Science

SUMMARY

The course **Database Management Systems** is part of the matter **Information systems and Intelligent Systems** and is a subject of 6 ECTS, taught in the first semester of the third year of the Degree in Computer Engineering. This course deals with the internals of programs and systems that allow to manage databases.

The course seeks to understand the problem of the design of database management systems (DBMS) and analyze in depth the basic functional elements of a DBMS and the algorithms they use to perform its function.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Good knowledge of Programming (taught in the first year) and Algorithms and Data Structure and also Databases (taught in second year) are highly recommended.

OUTCOMES

1400 - Degree in Computer Engineering

- G1 - Ability to design, write, organise, plan, develop and sign projects in the field of computer engineering aimed at the design, development or exploitation of computer systems, services and applications.
- G2 - Ability to lead project activities in the field of information technology, in accordance with both the knowledge and the specific skills acquired in the degree.
- G3 - Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, and of the information that these manage.
- G5 - Ability to design, develop and maintain computer systems, services and applications using software engineering methods as an instrument for quality assurance, in accordance with both the knowledge and the specific skills acquired in the degree.
- G6 - Ability to design and develop computer systems and centralised or distributed computer architectures which integrate hardware, software and networks, in accordance with both the knowledge and the specific skills acquired in the degree.
- G7 - Ability to recognise, understand and apply the legislation required in the professional practice of computer engineering and to deal with mandatory specifications, regulations and standards.
- R1 - Ability to design, develop, select and evaluate computer applications and systems while ensuring their reliability, safety and quality, according to ethical principles and current legislation and regulations.
- R4 - Ability to draw up the technical specifications of a computer system, according to standards and regulations.
- R5 - Knowledge, management and maintenance of computer systems, services and applications.
- R8 - Ability to analyse, design, build and maintain applications in a robust, secure and efficient manner by choosing the most suitable paradigm and programming languages.
- R12 - Knowledge and application of the features, functionalities and structure of databases which enable their proper use, and ability to design, analyse and implement applications based on them.

- R13 - Knowledge and application of the tools needed for the storage of, processing of and access to information systems, including web-based systems.
- TI2 - Ability to select, design, implement, integrate, evaluate, build, manage, exploit and maintain hardware, software and network technologies, within adequate cost and quality thresholds.
- TI5 - Ability to select, implement, integrate and manage information systems that meet the needs of the organisation taking account of cost and quality criteria.
- TI6 - Ability to design systems, applications and services based on network technologies, including the Internet, the web, e-commerce, multimedia, interactive services and mobile computing.
- SI1 - Ability to integrate ICT solutions into business processes in order to meet the information needs of organisations, thus enabling them to achieve their goals effectively and efficiently and providing them with competitive advantage.
- SI2 - Ability to determine the requirements of an organisations information and communication systems, considering safety aspects and compliance with regulations and legislation.
- SI3 - Ability to actively participate in the specification, design, implementation and maintenance of information and communication systems.

LEARNING OUTCOMES

- Understand the concepts related to information storage and retrieval.
- Understand the problems of the design a DBMS and the need for each of its components.
- Know in depth the functional elements of a DBMS and evaluate critically and compare the algorithms used by the different DBMS to perform its function.
- Analyze and properly characterize the performance issues associated with data-intensive applications and have the expertise to take adjustment and optimization solutions.
- Design policies for high availability and recovery from failures and disasters on critical information systems.

DESCRIPTION OF CONTENTS

1. Introduction to Database Management Systems.

Concepts and objectives of Database Management Systems. Modules and functionality of a DBMS.

2. Physical structures for data storage.

External storage. File organization. Indexes. Dynamic index structures: B trees. Dispersion indexes.

3. Query optimization.

Evaluation of relational operations: selection, projection, join, set operations and aggregation operations. Query Optimization: estimating the cost of a plan, relational algebra equivalences, other approaches to query optimization.

4. Transaction processing.

The ACID properties. Concurrent execution of transactions. Locking techniques for concurrency control. Performance and locks. Concurrency control without blocking: timestamps and multiversion.

5. Database recovery.

The system log. Backups. Recovery techniques based on deferred update and immediate update. The ARIES recovery algorithm.

6. Database security.

Overview of security in databases. Access control. Security features of the database administrator. Regulations and security requirements.

7. DBMS architecture and DB administration : Oracle

Architecture of a particular DBMS. Introduction to DBMS administration.

8. Advanced databases.

Selected and advanced topics on databases and database management.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Development of group work	10,00	0
Development of individual work	10,00	0
Study and independent work	25,00	0
Preparation of evaluation activities	25,00	0
Resolution of case studies	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Activities will be conducted according to the following distribution:

- **Theoretical activities**. During lectures, the key and most complex aspects will be explained in detail. Student participation will be promoted.
- **Practical activities** that complement the theoretical activities. These include the following: exercise based lectures, discussion sessions, labs and scheduled tutorials. During the practical activities, students will apply the concepts to solve a range of practical challenging problems.
- **Student's individual work**. This includes the realization (outside the classroom) of monographs, literature research, questions, problems, and the preparation of classes and exams (study). These are done individually and attempt to promote autonomous learning.
- **Teamwork**. Team work done in small groups (2-4) outside the classroom. This type of activity attempts to develop teamwork skills.

EVALUATION

The evaluation of the course will be conducted by:

- X: Objective evaluation (exams), consisting of one or more tests including both questions and problems.
- L: Evaluation of laboratory practices.
- EC: Continuous assessment based on participation and involvement in the teaching-learning process.

The final course grade will be composed as

X*0,50+L*0,25+EC*0,25

conditioned to achieve a minimum of 5 (of 10) in each of the X and L parts and in some specified items, and a minimum of 5 (of 10) is needed to pass the course.

In case of a second chance, the marks obtained in block EC (considered as a whole "not recoverable") will be maintained, and the student may improve or obtain marks in sections X (throught a global exam) and L (presenting or improving laboratory practices when possible), and the abovementioned weights and requirements will be applied.

In any case, the evaluation of this subject will be done in compliance with the University Regulations in this regard, approved by the Governing Council on 30th May 2017 (ACGUV 108/2017)

REFERENCES

Basic

- Fundamentos de bases de datos
  Abraham Silberschatz, Henry F. Korth, S. Sudarshan
  Ed. McGraw-Hill, 7ª edición, 2019
  [disponible UV: 5ª edición, 2006; Recurs electrònic]
- Sistemas de Bases de Datos
  Ramez A. Elmasri, Shamkant B. Navathe
  Pearson Educación, 7ª edición, 2017
  [disponible UV: 5ª edición, 2007; Recurs electrònic]
- Sistemas de gestión de bases de datos
  Raghu Ramakrishnan, Johannes Gehrke
  Ed. McGraw-Hill, 3ª edición, 2013
  [disponible UV: 3ª edición, 2013; Recurs electrònic]

Additional

- Database Systems: A Practical Approach to Design, Implementation, and Management.
  Thomas Connolly, Carolyn Begg.
  Pearson, 6ª edición, 2015
  [disponible UV: 2ª edición, 2002]