Universidad de Alcalá

TEACHING GUIDE

Databases

Degree in
Information System Engineering (GISI)
Computer Engineering (GIC)
Computer Science Engineering (GII)
Computer Science Engineering and Business Management and Administration (GII-ADE)

Universidad de Alcalá

Academic Year 2026/2027

2nd Year - 1st Semester (GISI+GIC+GII+GII-ADE)

Approved by the EPS School Board on June 15th, 2026

TEACHING GUIDE

Course Name:	**Databases**
Code:	**780016 (GISI+GIC+GII+GII-ADE)**
Degree in:	**Information System Engineering (GISI)** **Computer Engineering (GIC)** **Computer Science Engineering (GII)** **Computer Science Engineering and Business Management and Administration (GII-ADE)**
Department and area:	**Ciencias de la Computación** **Computer Science**
Type:	**Compulsory (GISI+GIC+GII)** **General (GII-ADE)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year - 1st Semester (GISI+GIC+GII+GII-ADE)**
Teachers:	Por definir
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	English

1. COURSE SUMMARY

The information amount available over the world is been doubled every 18 months. "Customers" require a more personalized and accurate treatment and "companies" become increasingly dependent on their data. Maintain and operate such a volume of information recommends using tools that help ensure the integrity and reliability of the data, arranging them so that they can be recovered efficiently when necessary, precisely to the degree of detail required at all times.

In this subject the student faces the classic phases of design and development of databases, using the Model Entity/Relationship for modelling and initial design, the Relational Model and the Normalization theory as tools to structure the information to be stored. Then, the student define and exploit the data in a Management System Relational Database using respectively the DDL and DML SQL languages, capturing as much semantics of the real world as possible to ensure logical consistency. Finally, we approach the integration of the database in the current context of exploitation through application programming interfaces for database connectivity.

Prerrequisites and recommendations:

Data structures and programming modules are recommended modules that should have been taken before this module.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following basic, generic and cross curricular skills:

en_CG1 - Ability to conceive, write, organize, plan, develop and sign projects in the field of computer engineering that are intended, in accordance with the knowledge acquired as established in section 5, annex 2, of resolution BOE-A -2009-12977, the conception, development or exploitation of computer systems, services and applications.

en_CG3 - Ability to design, develop, evaluate and ensure accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.

en_CG4 - Ability to define, evaluate and select hardware and software platforms for the development and execution of computer systems, services and applications, in accordance with the knowledge acquired as set out in section 5, annex 2, of resolution BOE-A-2009 -12977.

en_CG5 - Ability to conceive, develop and maintain computer systems, services and applications using software engineering methods as an instrument for quality assurance, in accordance with the knowledge acquired as established in section 5, annex 2, of the resolution BOE-A-2009-12977.

en_CG6 - Ability to conceive and develop centralized or distributed computer systems or architectures integrating hardware, software and networks in accordance with the knowledge acquired as set out in section 5, annex 2, of resolution BOEA-2009-12977.

en_CB1 - That students have demonstrated to possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

en_CB2 - That the students know how to apply their knowledge to their work or vocation in a professional manner and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

en_CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

en_CB4 - That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized public.

en_CB5 - That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Specific Skills

This course contributes to acquire the following professional skills:

en_CI1 - Ability to design, develop, select and evaluate applications and computer systems, ensuring their reliability, safety and quality, in accordance with ethical principles and current legislation and regulations.

en_CI7 - Knowledge, design and efficient use of the types and structures of data most appropriate to the resolution of a problem.

en_CI8 - Ability to analyze, design, build and maintain applications in a robust, safe and efficient way, choosing the most appropriate programming paradigm and languages.

en_CI12 - Knowledge and application of the characteristics, functionalities and structure of the databases, which allow their proper use, and the design and analysis and implementation of applications based on them.

en_CI13 - Knowledge and application of the necessary tools for storage, processing and access to Information Systems, including web-based ones.

Learning Outcomes

After succeeding in this subject the students will be able to:

RA1: Identify the problems that have led to the emergence of the concept of Database. Schematize the architecture and functionality of a database management system. Associate the mathematical foundations that allowed the development of the relational model with the characteristics of the SQL language

RA2: Identify the concepts of organizational data warehouses and their use for decision making applications

RA3: Know how to install a basic DBMS, as well as other tools to support the design and implementation of databases and put them into operation

RA4: Know how to use database management systems, including creation, maintenance and retrieval of information as well as access control, security and user permissions.

RA5: Knowing how to connect a database with a programming environment

RA6: Know how to capture the specifications of a part of the real world in a conceptual model, locating its semantic restrictions. Evolve this model through the different phases of data design: logical and physical model to create a database application that solves the specified problem

RA7: Ability to build test cases that validate the set down processes.

RA8: Ability to search information of any of the contexts in which Databases are exploited today, and implement it by choosing the most convenient tools for this

RA9: Understand the role that standards have in Engineering in general and Databases in particular and the convenience of adherence to standards and their professional practice.

RA10: Become aware of the need for an exhaustive search for quality in maintenance and responsibility in the use of the data they use in the exercise of their profession.

RA11: Value the benefits of teamwork and get used to making a public recognition of the contributions of colleagues

3. CONTENTS

Contents Blocks	Total number of hours
1. Introduction to databases.	4 hours
2. Database models a. Entity-Relationship model and database design	18 hours
3. Relational databases a. Relational model b. Tools: relational design tools and DBMS c. Relational algebra and calculus d. Structured Query Language (SQL) 3. Good practices:	20 hours
3. Good practices: a. Restrictions, referential integrity and triggers. b. Normalisation theory	14 hours

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	60 hours (56 hours on-site +4 exams hours)
Number of hours of student work:	90
Total hours	150

4.2. Methodological strategies, teaching materials and resources

In the teaching-learning process of the aforementioned contents, the following formative activities will be employed:

In-person activities:

- **In-person theoretical classes:** Presentation and discussion of the basic knowledge of the subject.
- **Practical classes:** Approach and resolution of exercises and cases, aimed at teaching the specific competencies of the subject, especially those related to basic knowledge.
- **Laboratory practices:** Approach and development of practical exercises that allow solving problems and analyzing hypotheses, contributing to the development of the capacity for result analysis, critical reasoning, and understanding of the proposed resolution methods. These will serve as a basis for acquiring the generic competencies described in section 2.
- **Tutorials:** Individual and/or group in-person sessions.

Non-in-person activities:

- Analysis and assimilation of the subject content, problem-solving, bibliographic consultation, preparation of individual and group work, personal study for in-person exams, and self-assessments.

Practical work is carried out with individual responsibility in small teams (2, at most 3 students), which offers the opportunity to train individual and team work planning and fosters attitudes that build synergy among members. This learning tool favors the analysis of different aspects of human communication: respect, empathy, collaboration between teams, tone of voice, and non-verbal communication. The subject provides the opportunity to practice the creation of different types of technical documents.

Two submissions have been planned, where the second one can be divided into successive stages. Having a sequence of submissions encourages continuous work on the subject and the planning of student learning.

Materials and teaching resources:

- Software for Database Design assistance
- Database Management System software for the subject to be developed
- Programming tools for creating utility programs for practical exercises on the designed/used databases
- Reference bibliography
- Personal computers
- Internet connection and Virtual Classroom Platform
- Projectors

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

The evaluation must be inspired by the criteria of continuous assessment (Learning Assessment Regulations, NEA, art. 9). However, respecting the regulations of the University of Alcalá, an alternative final evaluation process is made available to the student in accordance with the Learning Assessment Regulations (approved by the Governing Council on March 24, 2011, and modified by the Governing Council on July 22, 2021). According to Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Higher Polytechnic School their intention to opt for the non-continuous assessment model, stating the reasons they deem appropriate. The evaluation of the learning process of all students who do not submit a request or have it denied will be carried out, by default, according to the continuous assessment model. Students have two opportunities to pass the subject, one ordinary and one extraordinary.

Ordinary Call:

Continuous Assessment:

The evaluation in the ordinary call will be inspired by the criteria of Continuous Assessment, always attending to the acquisition of the competencies specified in the subject.

The main evaluation tools will be:

1. Intermediate Evaluation Tests (PEI): Written tests focused on both theoretical and practical aspects of the subject.
2. Laboratory Deliverables: Submission of laboratory activities.

3. Laboratory Tests (PL): Practical tests consisting of solving exercises related to the development of previous practices.

The student must attend all continuous assessment tests and laboratory tests, and must also attend at least 80% of the laboratory sessions. If unable to attend a session for a justified reason, they must present a document to attest to it.

Final Assessment:

Students who submit a written request to the School Directorate and have a justified cause may be evaluated through Final Assessment, provided the School Directorate grants it. They have a period of two weeks from the start of the subject classes to do so. The Final Assessment will consist of a theoretical written test and a practical part, which together will constitute 100% of the subject grade. It is mandatory to attend both tests. For the practical part, the student must contact the subject coordinator in the first weeks of class to agree on the delivery and evaluation date of the practice.

Extraordinary Call:

Students who have not passed the ordinary call will take a theoretical test and a practical part proposed for this call. Both tests will constitute 100% of the subject grade.

Those who have not passed one of the parts (theory or laboratory) in the ordinary call must take the corresponding part in the extraordinary call. The grade obtained in the ordinary call for the passed part is retained. It is essential to pass the mandatory practices carried out during the course to pass the subject, according to article 6.4 of the Learning Assessment Regulations. Therefore, students who have not passed the practical part of the subject must contact the subject coordinators during the first two weeks of class in the second semester to agree on the evaluation session(s) for the practices.

5.2. EVALUATION

EVALUATION CRITERIA

The assessment criteria measure the level in which the competences have been acquired by the student. For that purpose, the following are defined::

CE1. The student is able to extract the semantics of the data, their interrelations and their restrictions, from specifications of a real-world plot

CE2. The student is able to express the constraints and relationships between the data, modeling the problem plot, at a conceptual, logical and physical level, and justifying the design criteria used.

CE3. The student knows how to implement the design in a DBMS and is able to maintain and consult the information in it.

CE4. The student knows how to find solutions to the problems raised, in the manuals, to integrate the database in other computerized contexts.

CE5. The student expresses himself both orally and in writing using appropriate terminology and always assessing the contributions of other members of the class.

GRADING TOOLS

This section outlines the evaluation instruments that will be applied to each of the assessment criteria:

- Intermediate Evaluation Tests (PEI): Written tests to be conducted throughout the course. There will be two during the course.
- Laboratory Deliverable (EL): Submissions of laboratory work with results and conclusions of the practices proposed throughout the course.
- Laboratory Test (PL): Practical laboratory tests to be conducted during the course.
- Final Evaluation Test (PEF): Test to be taken by students who opt for the final evaluation. It will consist of a theoretical written part (PEFT) and a practical laboratory part (PEFL).

GRADING CRITERIA

Ordinary call: Continuous assessment

In the ordinary call-continuous assessment the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TRU1-TRU3, TRU5,CI1,CI7, CI12,CI13	RA1,RA2,RA4,RA6, RA9	CE1-CE5	PEI1	30%
CG1,CG4,CG5,TRU1-TRU3, TRU5,CI1,CI8, CI12, CI13	RA3,RA4,RA6,RA7, RA11	CE1-CE5	E1, PL1	20%
TRU1-TRU3, TRU5,CI1,CI7, CI12, CI13	RA1,RA4,RA9,RA10	CE1-CE5	PEI2	30%
CG1,CG4,CG5,TRU1-TRU3, TRU5, CI1,CI8, CI12, CI13	RA4,RA5,RA7,RA8, RA11	CE1-CE5	E2, PL2	20%

Ordinary call: Final evaluation

In the ordinary call-final evaluation, the relationship between the competences, learning outcomes, criteria and evaluation instruments is as

follows.

Skills	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final Mark
TRU1-TRU3, TRU5;CI1,CI12,CI13,CI17	RA1,RA2,RA4,RA6 RA9,RA10	CE1-CE5	PEFT	60%
CG1,CG3,CG4,CG5,CG6,TRU1- TRU3, TRU5,CI1,CI8,CI112,CI13	RA3,RA4 RA5,RA6,RA7,RA8,RA11	CE1-CE5	PEFL	40%

As a general criterion, students who, in the ordinary examination session, take less than 50% of all the corresponding assessments will be considered **Not Presented**. The instructor may decide, in accordance with the competencies and learning outcomes achieved in previous sessions, which assessments each student must complete in the Ordinary Examination Session.

The subject is considered passed in the ordinary call under continuous assessment if the following criteria are met:

- Having attended and successfully passed the evaluation of the competencies related to all theoretical tests (PEI1 and PEI2). It will be understood that students acquire these competencies satisfactorily if their grade in the related tests is equal to or greater than 40% of the maximum obtainable score.
- Having successfully passed the evaluation of the competencies related to laboratory practices (PL). For this, it is essential that students complete all practices and attend all laboratory tests (E1, PL1, and E2 PL2), obtaining a grade in these tests equal to or greater than 40% of the maximum obtainable score.
- Obtaining a final weighted grade of all defined continuous assessment tests equal to or greater than 5 out of 10 points.

The subject is considered passed in the ordinary call under the final assessment modality if the following criteria are met:

- Having attended and successfully passed the evaluation of the theoretical test. It will be understood that students acquire these competencies satisfactorily if their grade in the related tests is equal to or greater than 40% of the maximum obtainable score.
- Having successfully passed the evaluation of the competencies related to laboratory practices. For this, it is essential that students obtain a grade equal to or greater than 40% of the maximum obtainable score.
- Obtaining a final weighted grade of the tests equal to or greater than 5 out of 10 points.

Extraordinary call

Skills	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final Mark
TRU1-TRU3, TRU5;CI1,CI12,CI13,CI17	RRA1,RA2,RA4,RA6 RA9,RA10	CE1-CE5	PEFT	60%
CG1,CG3,CG4,CG5,CG6,TRU1- TRU3, TRU5,CI1,CI8,CI112,CI13	RA3,RA4,RA5,RA6,RA7,RA8,RA11	CE1-CE5	PEFL	40%

As a general criterion, students who, in the extraordinary examination session, do not attend the assessment of all the corresponding assessments will be considered **Not Presented**. The instructor may decide, in accordance with the competencies and learning outcomes achieved in the ordinary examination session or the Final Assessment, which assessments each student must complete in the Extraordinary Examination Session.

The subject is considered passed in the extraordinary call if the following criteria are met:

- Having attended and successfully passed the evaluation of the theoretical test. It will be understood that students acquire these competencies satisfactorily if their grade in the related tests is equal to or greater than 40% of the maximum obtainable score.
- Having successfully passed the evaluation of the competencies related to laboratory practices. For this, it is essential that students obtain a grade equal to or greater than 40% of the maximum obtainable score.
- Obtaining a final weighted grade of the tests equal to or greater than 5 out of 10 points.

The teaching-learning methodology and the assessment process will be adapted as needed, in accordance with the guidelines of the Diversity Support Unit, to implement curricular adaptations for students with specific needs.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- SILBERSCHATZ A. Fundamentos de Diseño de Bases de Datos, McGraw-Hill (2014). https://bibliobuscador.uah.es/permalink/f/165vdu9/34UAH_ALMA5163350620004214
- CONNOLLY, T.M. Sistemas de Bases de Datos: un enfoque práctico para diseño, implementación y gestión.4a ed., Reimp.,

Pearson Addison Wesley, 2011. https://bibliobuscador.uah.es/permalink/f/d835tr/34UAH_ALMA5163419690004214

6.2. Additional Bibliography

- DATE, C.J. Introducción a los Sistemas de Bases de Datos, Prentice Hall (2002)
- ELMASRI R., NAVATHE S.B.. Fundamentos de Sistemas de Bases de Datos, Pearson (2007). https://bibliobuscador.uah.es/permalink/f/165vdu9/34UAH_ALMA5163437170004214

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.