UNIVERSIDAD DE GRANADA

ETSIIT
Escuela Técnica Superior de Ingenierías Informática y de Telecomunicación

BACHELOR'S DEGREE IN COMPUTER ENGINEERING AT THE UNIVERSITY OF GRANADA

PRESENTATION

Total credits: 240
Optative credits: 30

The Degree in Computer Engineering at the University of Granada is offered at two different centres:

- Escuela Técnica Superior de Ingeniería Informática y de Telecomunicación in the city of Granada.
- Facultad de Educación y Humanidades in the city of Ceuta.

Graduates in Computer Engineering from the University of Granada will be professionals with solid training in all the main fields of computer science. They will be specialists who respond to the expectations of the work world, as they will be prepared to adapt to the changes in an area such as Information and Communication Technologies (ICT). Graduates will be professionals with a global vision of technology and companies. They will be able to analyze, design, develop and implement different types of computer systems. They will be capable of proposing innovative solutions, both in terms of products and IT processes and services, to different types of organizations.

Degree approved by ANECA and recognized by the Euro-Inf International Quality Seal, awarded by the European Quality Assurance NetWork for Informatics Education (EQANIE). This accreditation is on force until further evaluation on 5 June 2025. Obtaining this International Quality Seal involves three important aspects:

1. It guarantees that the degree meets the quality criteria agreed by international agencies, based on international standards recognized by employers in Europe.
2. It recognises the quality of a degree with the Seal both within and outside the country where it is taught, and this recognition is an incentive for potential students to choose it.
3. It assures employers of the graduates of a degree with the International Quality Assurance Label that the knowledge and practical competences of the graduates of the degree meet a set of international standards of education in the field of the degree.

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SPECIALISATIONS

Available mentions of the degree at UGR:

- **Specialisation in Computation and Intelligent Systems**
  This specialization focuses on the field of Artificial Intelligence and, specifically, its most advanced aspect, Intelligent Systems. This profile seeks to discover the secrets of human intelligence, extend the functional capabilities of machines and explore human-machine interaction, with the idea of applying this knowledge to build innovative solutions with global impact. It is aimed at students who enjoy studying, modelling and solving complex computer problems. The specific subjects of this specialization provide an overview of the mechanisms of intelligent thought and behaviour and the techniques for programming them on a computer.

- **Specialisation in Software Engineering**
  Software Engineering specialists are involved in tasks such as project conception, solicitation and management, specification, analysis, design, programming, maintenance and testing of software systems, reporting, certification and consulting.

- **Specialisation in Computer Engineering**
  Computer Engineering deals with the conception, design, construction and maintenance of computer systems in general. It is involved in aspects related to both hardware and software, ranging from the development of digital circuits to the design and maintenance of all type of computers (supercomputers, servers, personal computers, mobile computers, etc.). One of the main objectives of computer engineering is the integration of electronic equipment (hardware) with

programming (software) and telecommunications to build efficient computer systems that improve the performance of current systems and offer new possibilities for future applications, allowing previously unsolvable problems to be tackled in acceptable times.

- **Specialisation in Information Systems**
  Information Systems consists of a set of elements oriented to the processing and management of data and information, organised and ready for later use, generated to cover a need or an objective. Examples include EIS, GIS, Social Networks, e-Administration and Research Information Systems. The Information Systems manager is responsible for planning, developing, acquiring or administering the ICT infrastructure, managing data (internal and external), facilitating and controlling the flow of information between the various stakeholders (customers-suppliers-staff-management) and tracking new technologies and assisting in their incorporation into the company's strategy, planning and practices.

- **Specialisation in Information Technology**
  This specialization enables the student to:
    - Understand the environment of an organisation and its needs in the field of information and communication technologies.
    - Select, design, deploy, integrate, evaluate, build, manage, operate and maintain hardware, software and network technologies, within the appropriate cost and quality parameters.
    - Employ user- and organisation-centred methodologies for the development, evaluation and management of IT-based applications and systems to ensure accessibility, ergonomics and usability of systems.
    - Select, design, deploy, integrate and manage communications networks and infrastructures in an organization.
    - Select, deploy, integrate and manage information systems that meet the needs of the organisation, with identified cost and quality criteria.
    - Design systems, applications and services based on network technologies, including the Internet, web, e-commerce, multimedia, interactive services and mobile computing.
    - Understand, implement and manage the security and safety of IT systems.
      Career opportunities include: technology transfer manager or ICT solutions consultant.

TRADUCCIÓN DE LA BREVE DESCRIPCIÓN Y COMPETENCIAS DE LAS ASIGNATURAS DE PRIMER CURSO DEL GRADO EN INGENIERÍA INFORMÁTICA

TRANSLATION OF THE BRIEF DESCRIPTION AND SKILLS OF THE SUBJECTS OF THE FIRST ACADEMIC YEAR – BACHELOR'S DEGREE IN COMPUTER ENGINEERING

PRIMER CURSO – FIRST ACADEMIC YEAR
1º Semestre – 1º Semester

ÁLGEBRA LINEAL Y ESTRUCTURAS MATEMÁTICAS – LINEAR ALGEBRA AND MATHEMATICAL STRUCTURES

ACADEMIC YEAR	SEMESTER	CREDITS
1º	1º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Sets, relations and functions. Arithmetic of integers and polynomials. Applications. Combinatorics. Vector spaces and linear applications. Matrices and systems of equations. Diagonalization.

GENERAL AND SPECIFIC SKILLS
Basic and General Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills

- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.

Subject Specific Skills

- B1 – Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.

- B3 – Understanding and knowledge of the basis of discrete mathematics, logic, algorithmic and complex computing, and its application to the problem solving typical of engineering.

CÁLCULO - CALCULUS

ACADEMIC YEAR	SEMESTER	CREDITS
1º	1º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Differential calculus in one variable.
- Integral calculus in one variable.
- Numerical methods for differential and integral calculus.
- Numerical algorithms.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- B1 – Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.

Basic Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills

- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.

FUNDAMENTOS DEL SOFTWARE – SOFTWARE FUNDAMENTALS

ACADEMIC YEAR	SEMESTER	CREDITS
1º	1º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Components of a computer system.
- Components of an Operating System.
- Operating system services: system calls and command interpreters.
- Compiling, linking and loading programs.
- Application development environments and tools.
- Databases.
- Engineering applications.

GENERAL AND SPECIFIC SKILLS

Degree Specific Skills

- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.

Module Specific Skills

- B4 – Basic knowledge in computing and programming, operative systems, databases and informatics programmes with application in engineering.

Basic Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills

- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.

FUNDAMENTOS DE PROGRAMACIÓN – PROGRAMMING FUNDAMENTALS

ACADEMIC YEAR	SEMESTER	CREDITS
1º	1º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Please fill in the appropriate text in each case.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Module Specific Skills

- B4 – Basic knowledge in computing and programming, operative systems, databases and informatics programmes with application in engineering.
- B5 – Knowledge of the structure, organization, running and interconnection of the informatics systems, the principle of its programming, and its application to the problem solving typical of engineering.

Transversal Skills

- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.

FUNDAMENTOS FÍSICOS Y TECNOLÓGICOS – FUNDAMENTALS OF PHYSICS AND TECHNOLOGY

ACADEMIC YEAR	SEMESTER	CREDITS
1º	1º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Fundamental concepts of electromagnetism. Fundamentals of circuit theory. Analysis of direct current and alternating current circuits. Fundamentals of electronic devices. Basic principles of logic families and digital logic. Operational amplifiers.

GENERAL AND SPECIFIC SKILLS
Subject Specific Skills

- B2 – Understanding and knowledge of the basis of fields, waves and electromagnetism, theory of the electric circuits, electronic circuits, physical principle of the semiconductors and logic families, photonic and electronic devices, and its application to the problem solving typical of Engineering.

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills

- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.

2º Semestre – 2º Semester

ESTADÍSTICA - STATISTICS

ACADEMIC YEAR	SEMESTER	CREDITS
1º	2º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- One- and two-dimensional descriptive statistics.
- Probability. Calculus of probabilities. Random variable and distribution function.
- Basic models of discrete and continuous one-dimensional distributions.
- Parameter estimation and hypothesis testing. Fitting of distributions.
- Optimization techniques in Operations Research.

GENERAL AND SPECIFIC SKILLS

Subject and Degree Specific Skills / General or Transversal Skills

- B1 – Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about linear algebra; geometry; differential geometry;

differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.

INGENIERÍA, EMPRESA Y SOCIEDAD – ENGINEERING, BUSINESS AND SOCIETY

ACADEMIC YEAR	SEMESTER	CREDITS
1º	2º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Companies as socio-economic reality: company tipologies.
- Companies and their environment: introduction to strategic management.
- Functional subsystems of companies.
- Human resources management.
- The market in the ICT sector.
- Creation of spin-offs and management of companies in the sector.
- Management of companies in the ICT sector.
- Social and environmental impact of technical solutions.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E11 – Ability to analyse and assess the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of a Technical Engineer in Computer Science.
- E12 – Knowledge and application of basic elements of economics and human resources management, project organisation and planning, as well as the legislation, regulation and standardisation in the field of IT projects, according to the knowledge acquired.

Module Specific Skills

- B6 – Adequate knowledge to the enterprise concept, institutional and legal frame of the company. Organisation and business management.

Transversal Skills

- T7 – Respect for fundamental and equality rights.

- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

LÓGICA Y MÉTODOS DISCRETOS – LOGIC AND DISCRETE METHODS

ACADEMIC YEAR	SEMESTER	CREDITS
1º	2º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Induction and recurrence.
- Boolean algebras and Boolean functions.
- Propositional logic.
- First order logic.
- Unification and resolution.
- Graphs and trees.

GENERAL AND SPECIFIC SKILLS

Basic and General Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills

- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.

Subject Specific Skills

- B1 – Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.
- B3 – Understanding and knowledge of the basis of discrete mathematics, logic, algorithmic and complex computing, and its application to the problem solving typical of engineering.

METODOLOGÍA DE LA PROGRAMACIÓN – PROGRAMMING METHODOLOGY

ACADEMIC YEAR	SEMESTER	CREDITS
1º	2º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
High-level language data types and their internal representation. Memory references and dynamic memory. Encapsulation and information hiding. Modular design and library creation debugging tools testing and validation. Error handling. Software maintenance. I/O, files. Computer programming project.

GENERAL AND SPECIFIC SKILLS
Module Specific Skills

- B4 – Basic knowledge in computing and programming, operative systems, databases and informatics programmes with application in engineering.
- B5 – Knowledge of the structure, organization, running and interconnection of the informatics systems, the principle of its programming, and its application to the problem solving typical of engineering.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

TECNOLOGÍA Y ORGANIZACIÓN DE COMPUTADORES – COMPUTER TECHNOLOGY AND ORGANIZATION

ACADEMIC YEAR	SEMESTER	CREDITS
1º	2º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Computer organization and components. Basic performance. Conceptual levels of description of a computer. Representation of information on the computer. Basic components. Combinational circuits. Sequential circuits. Description of computer operations at the register-to-register transfer level.

GENERAL AND SPECIFIC SKILLS
Module Specific Skills

- B5 – Knowledge of the structure, organization, running and interconnection of the informatics systems, the principle of its programming, and its application to the problem solving typical of engineering.

Degree General Skills

- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.

Transversal Skills

- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.

TRADUCCIÓN DE LA BREVE DESCRIPCIÓN Y COMPETENCIAS DE LAS ASIGNATURAS DE SEGUNDO CURSO DEL GRADO EN INGENIERÍA INFORMÁTICA

TRANSLATION OF THE BRIEF DESCRIPTION AND SKILLS OF THE SUBJECTS OF THE SECOND ACADEMIC YEAR – BACHELOR'S DEGREE IN COMPUTER ENGINEERING

SEGUNDO CURSO – SECOND ACADEMIC YEAR
1º Semestre – 1º Semester

ESTRUCTURA DE COMPUTADORES – COMPUTER ORGANIZATION

ACADEMIC YEAR	SEMESTER	CREDITS
2º	3º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Instruction repertoire architecture. Structure of a computer at the machine language level and assembly programming. Relationship between high-level and assembly languages; data representation and simple structures. Memory system Input/Output system buses. Processor organization: hard-wired and microprogrammed control, channel segmentation, etc.

GENERAL AND SPECIFIC SKILLS
Subject Specific Skills
R9 – Ability to know, understand and evaluate the structure and architecture of computers, as well as the basic components of them.

Degree Specific Skills
E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal or General Skills
T1 – Ability to organise and plan as well as ability to manage Information.
T3 – Ability to use and apply ICT in the academic and professional field.

ESTRUCTURA DE DATOS – DATA STRUCTURES

ACADEMIC YEAR	SEMESTER	CREDITS
2º	3º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Introduction to the efficiency of algorithms. Abstract Data Type (ADT). Specification and implementation of Abstract Data Types (ADTs): lists, stacks, queues, trees, hash tables, graphs.

GENERAL AND SPECIFIC SKILLS
Module Specific Skills
R7 – Knowledge, design and efficiently use of the most adequate data types and structures for solving a problem.

Degree General Skills
E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills
T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.

PROGRAMACIÓN Y DISEÑO ORIENTADO A OBJETOS – OBJECT ORIENTED PROGRAMMING AND DESIGN

ACADEMIC YEAR	SEMESTER	CREDITS
2º	3º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Concepts, techniques and notations.
Classes and objects.
Polymorphism.

Inheritance.
Design with polymorphism and inheritance.
Reuse.
MVC pattern.

GENERAL AND SPECIFIC SKILLS
Degree General Skills
E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Module Specific Skills
R1 – Ability to design, develop, select and evaluate applications and informatics systems, assuring its fidelity, security and quality, according to ethic principles and to the legislation and existing rules.
R8 – Ability to analyse, design, build and maintain applications in a strong, secure and efficient way, choosing the most adequate paradigm and programming language.

Basic Skills
CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills
T1 – Organisation and planning skills as well as information management skills.

SISTEMAS CONCURRENTES Y DISTRIBUIDOS – CONCURRENT AND DISTRIBUTED SYSTEMS

ACADEMIC YEAR	SEMESTER	CREDITS
2º	3º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Mutual exclusion, synchronization and inter-process communication. Security properties and liveness. Algorithms for models based on shared memory and message passing.

Semaphores and monitors. Concurrent and distributed programming libraries. Techniques for the design of real-time applications.

GENERAL AND SPECIFIC SKILLS
Degree General Skills
E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Module Specific Skills
R6 – Knowledge and application of the basic algorithmic procedures of the informatics technologies to design solutions to problems – analysing the suitability and complexity of such algorithms.
R8 – Ability to analyse, design, build and maintain applications in a strong, secure and efficient way, choosing the most adequate paradigm and programming language.
R11 – Knowledge and application of the characteristics, functionalities and structure of the Distributed Systems, the Computing Networks and the Internet, and the design, analyse and implementation of applications based on them.
R14 –Knowledge and application of the main principles and basic technics of parallel, concurrent, distributed and real time programming.

Basic Skills
CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills
T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.

SISTEMAS OPERATIVOS – OPERATING SYSTEMS

ACADEMIC YEAR	SEMESTER	CREDITS
2º	3º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Hardware support for the operating system.
Process management design and implementation.
Memory management.
File systems.
Operating system security mechanisms.

Programming applications using operating system services.
Operating system administration.

GENERAL AND SPECIFIC SKILLS
Module Specific Skills
R10 – Knowledge of the characteristics, functionalities and structures of Operative Systems and ability to design and implement applications based on their services.

Basic Skills
CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

General Skills
E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
E11 – Ability to analyse and assess the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of a Technical Engineer in Computer Science.

Transversal Skills
T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

2º Semestre – 2º Semester

ALGORÍTMICA – ALGORITHMICS

ACADEMIC YEAR	SEMESTER	CREDITS
2º	4º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Analysis of the efficiency of algorithms. Design of algorithms. Techniques: divide and conquer algorithms, voracious algorithms, graph exploration and dynamic programming.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Module Specific Skills
R6 – Knowledge and application of the basic algorithmic procedures of the informatics technologies to design solutions to problems – analysing the suitability and complexity of such algorithms.

Basic Skills
CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Transversal Skills
T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

ARQUITECTURA DE COMPUTADORES – COMPUTER ARCHITECTURE

ACADEMIC YEAR	SEMESTER	CREDITS
2º	4º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Structure and classification of parallel architectures (processors, multiprocessors, multicomputers and distributed systems). Classification of the parallelism of an application. Architectures with instruction level parallelism (ILP). Efficient ILP programming (basic code optimization algorithms and mechanisms), multicore and multiprocessor architectures. Parallel programming. Performance evaluation.

GENERAL AND SPECIFIC SKILLS
Subject Specific Skills
R8 – Ability to analyse, design, build and maintain applications in a strong, secure and efficient way, choosing the most adequate paradigm and programming language.
R9 – Ability to know, understand and evaluate the structure and architecture of computers, as well as the basic components of them.

R14 –Knowledge and application of the main principles and basic technics of parallel, concurrent, distributed and real time programming.

Degree Specific Skills
E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal or General Skills
T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

FUNDAMENTOS DE BASES DE DATOS – DATABASE FUNDAMENTALS

ACADEMIC YEAR	SEMESTER	CREDITS
2º	4º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Databases and database management systems. DBMS architecture. Data models: the conceptual design. Relational databases.

GENERAL AND SPECIFIC SKILLS
Basic Skills
CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Subject Specific Skills
R12 – Knowledge and application of the characteristics, functionalities and structures based on database, allowing an adequate use; and the design, analyse and implementation of applications based on them.
R13 – Knowledge and application of the necessary tools to the storage, processing and access to the Information System, including the network based ones.

Degree General Skills

E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal or General Skills
T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.

FUNDAMENTOS DE INGENIERÍA DEL SOFTWARE – SOFTWARE ENGINEERING FUNDAMENTALS

ACADEMIC YEAR	SEMESTER	CREDITS
2º	4º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Please fill in the appropriate text in each case.

GENERAL AND SPECIFIC SKILLS
Degree General Skills
E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Module Specific Skills
R1 – Ability to design, develop, select and evaluate applications and informatics systems, assuring its fidelity, security and quality, according to ethic principles and to the legislation and existing rules.
R2 – Ability to plan, create, deploy and lead informatics projects, services and systems in every field, leading its start and continuous improvement and evaluating its economic and social impact.
R3 – Ability to understand the importance of negotiation, effective work habits, leadership and skills to communicate in every software development environment.
R4 – Ability to write a document about the technical conditions of an informatics facility which follows the standards and existing rules.
R5 – Knowledge, management and maintenance of informatics systems, services and applications.
R8 – Ability to analyse, design, build and maintain applications in a strong, secure and efficient way, choosing the most adequate paradigm and programming language.
R16 – Knowledge and application of the principles, methodologies and life cycles of software engineering.
R17 – Ability to design and evaluate computing persona interfaces which guarantee the accessibility and utility to the informatics systems, services and applications.

Basic Skills
CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills
T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.

INTELIGENCIA ARTIFICIAL – ARTIFICIAL INTELLIGENCE

ACADEMIC YEAR	SEMESTER	CREDITS
2º	4º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Fundamentals of A.I. Knowledge representation. Searching. Learning. Applications of A.I.

GENERAL AND SPECIFIC SKILLS
Shared Skills

R15 – Knowledge and application of the main principles and basic technics in the intelligent systems and its practice application.

Degree General Skills

E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Transversal Skills

T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

TRADUCCIÓN DE LA BREVE DESCRIPCIÓN Y COMPETENCIAS DE LAS ASIGNATURAS DE TERCER CURSO DEL GRADO EN INGENIERÍA INFORMÁTICA

TRANSLATION OF THE BRIEF DESCRIPTION AND SKILLS OF THE SUBJECTS OF THE THIRD ACADEMIC YEAR – BACHELOR'S DEGREE IN COMPUTER ENGINEERING

1º Semestre – 1º Semester

Diseño y Desarrollo de Sistemas de Información - Information Systems Design and Development

ACADEMIC YEAR	SEMESTER	CREDITS
3º	5º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Database Design (Relational Design, Objected Oriented Design).
- Application Development in Information Systems (introduction to web programming).
- Web-based Information Systems.

GENERAL AND SPECIFIC SKILLS

Basic and General Skills

- CB2 – Students should be able to apply their knowledge to their work or vocation in a professional way, and possess the competences demonstrated through the development and defence of arguments and problem solving in their field of study.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills

- T1 – Ability to organise and plan as well as ability to manage Information.
- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

- T3 – Ability to use and apply ICT in the academic and professional field.
- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.

Specific Skills

- R1 – Ability to design, develop, select and evaluate applications and informatics systems, assuring its fidelity, security and quality, according to ethic principles and to the legislation and existing rules.
- R5 – Knowledge, management and maintenance of informatics systems, services and applications.
- R7 – Knowledge, design and efficiently use of the most adequate data types and structures for solving a problem.
- R11 – Knowledge and application of the characteristics, functionalities and structure of the Distributed Systems, the Computing Networks and the Internet, and the design, analyse and implementation of applications based on them.
- R12 – Knowledge and application of the characteristics, functionalities and structures based on database, allowing an adequate use; and the design, analyse and implementation of applications based on them.
- R13 – Knowledge and application of the necessary tools to the storage, processing and access to the Information System, including the network-based ones.
- R17 – Ability to design and evaluate computing persona interfaces which guarantee the accessibility and utility to the informatics systems, services and applications.

Fundamentos de Redes – Network Fundamentals

ACADEMIC YEAR	SEMESTER	CREDITS
3º	5º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Network architectures. Communication protocols. OSI model. TCP/IP networks. User networks.

GENERAL AND SPECIFIC SKILLS

Module Specific Skills

- R11 – Knowledge and application of the characteristics, functionalities and structure of the Distributed Systems, the Computing Networks and the Internet, and the design, analyse and implementation of applications based on them.
- R13 – Knowledge and application of the necessary tools to the storage, processing and access to the Information System, including the network-based ones.
- R18 – Knowledge of the informatics rules and regulation in national, European and international fields.

Degree specific skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal skills

- T2 – Organisation and planning skills as well as information management skills.

Informática Gráfica - Computer Graphics

ACADEMIC YEAR	SEMESTER	CREDITS
3º	5º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Geometric modelling: hierarchical models, polygonal meshes. 3D visualization. Animation. Programming in a graphics library. Interaction.

Ingeniería de Servidores – Server Engineering

ACADEMIC YEAR	SEMESTER	CREDITS
3º	5º or 6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Components of a server: motherboard, processor, memory and hard disk. Design and configuration of an average server. Assembly and installation. Administration and evaluation of server features.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB2 – Students should be able to apply their knowledge to their work or vocation in a professional way, and possess the competences demonstrated through the development and defence of arguments and problem solving in their field of study.

Subject Specific Skills

- R1 – Ability to design, develop, select and evaluate applications and informatics systems, assuring its fidelity, security and quality, according to ethic principles and to the legislation and existing rules.

- R2 – Ability to plan, create, deploy and lead informatics projects, services and systems in every field, leading its start and continuous improvement and evaluating its economic and social impact.
- R4 – Ability to write a document about the technical conditions of an informatics facility which follows the standards and existing rules.
- R5 – Knowledge, management and maintenance of informatics systems, services and applications.
- R9 – Ability to know, understand and evaluate the structure and architecture of computers, as well as the basic components of them.

Degree Specific Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.

Transversal or General Skills

- T2 – Organisation and planning skills as well as information management skills.

Modelos de Computación – Models of Computation

ACADEMIC YEAR	SEMESTER	CREDITS
3º	5º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Introduction to Computing. Finite Automata and Regular Expressions. Context-Free Grammars. Battery-powered Automata. Deterministic Context-Free Languages. Context Dependent Languages.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- R6 – Knowledge and application of the basic algorithmic procedures of the informatics technologies to design solutions to problems – analysing the suitability and complexity of such algorithms.

Degree Specific Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB2 – Students should be able to apply their knowledge to their work or vocation in a professional way, and possess the competences demonstrated through the development and defence of arguments and problem solving in their field of study.

2º Semestre – 2º Semester

ESPECIALIDAD COMPUTACIÓN Y SISTEMAS INTELIGENTES – SPECIALISATION IN COMPUTATION AND INTELLIGENT SYSTEMS

Aprendizaje Automático – Machine Learning

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Machine learning models. Supervised and unsupervised classification. Model selection. Feature selection techniques. Validation and verification.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T4 – Ability to communicate in a foreign language, particularly in English.

Ingeniería del Conocimiento – Knowledge Engineering

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

The problem of knowledge acquisition and representation. Models of knowledge representation. Logical models, structured models, models for imprecise or uncertain knowledge. The concept of ontology and its uses. Knowledge-based systems. Architectures.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal or General Skills

- T2 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.

Metaheurísticas - Metaheuristics

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Advanced optimization and search algorithms. Design techniques for trajectory-based and population-based algorithms. Parallel metaheuristics.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.

Modelos Avanzados de Computación – Advanced Models of Computation

ACADEMIC YEAR	SEMESTER	CREDITS
3º	3º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Turing Machines. Other models of computation. Computability of problems. Computational Complexity. NP-Completeness.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Técnicas de los Sistemas Inteligentes – Intelligent Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Agents. Heuristic search. Planning. Robotics. Applications.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

ESPECIALIDAD INGENIERÍA DEL SOFTWARE – SPECIALISATION IN SOFTWARE ENGINEERING

Desarrollo de Sistemas Distribuidos – Distributed System Development

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Reference frameworks and settings (centralisation, distribution and replication).
- Message passing mechanisms.
- Time and coordination. Client/Server and Peer-to-Peer models and systems.
- Service Oriented Architecture (SOA), Event-Driven Architectures (EDA), component-based architectures, mobile agents.
- Middleware and platforms.
- Development methodologies for distributed systems or applications.
- Quality attributes: performance, scalability and fault tolerance.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

- IS1 – Ability to develop, maintain and evaluate software services and systems that satisfy all user requirements and perform reliably and efficiently, are affordable to develop and maintain and meet quality standards, applying the theories, principles, methods and practices of Software Engineering.
- IS3 – Ability to solve integration problems according to available strategies, standards and technologies.
- IS4 – Ability to identify and analyse problems and design, develop, implement, verify and report software solutions using an adequate knowledge of current theories, models and techniques.
- T2 – Organisation and planning skills as well as information management skills.

Degree Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E3 – Ability to design, develop, evaluate and assure the accessibility, ergonomics, utility and security of the informatics systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms to develop and to run informatics systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E9 – Ability to solve problems with initiative, making decisions, autonomy and creativity. Ability to know how to communicate and transmit the knowledge, skills and abilities for the Technical Engineer in Informatics career.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T11 – Ability to adapt to technologies and future environments updating professional skills.

Desarrollo de Software – Software Development

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Design patterns. Classification and composition of patterns. Software architectures. Model-driven development techniques. Business modelling. Software verification and validation techniques. Unit testing. Software maintenance and evolution.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.

Module Specific Skills

- IS1 – Ability to develop, maintain and evaluate software services and systems that satisfy all user requirements and perform reliably and efficiently, are affordable to develop and maintain and meet quality standards, applying the theories, principles, methods and practices of Software Engineering.

- IS3 – Ability to solve integration problems according to available strategies, standards and technologies.
- IS4 – Ability to identify and analyse problems and design, develop, implement, verify and report software solutions using an adequate knowledge of current theories, models and techniques.

Transversal Skills

- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.

Diseño de Interfaces de Usuario – User Interface Design

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Human-computer interaction. User interface. User Experience and Interaction Design. Tools for the design. The human factor. Architecture of an interactive system. Interaction devices and tasks.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- IS2 – Ability to assess customer needs and specify software requirements to satisfy these needs, reconciling conflicting goals by seeking acceptable compromises within the constraints of cost, time, existing developed systems and the organisations themselves.
- IS4 – Ability to identify and analyse problems and design, develop, implement, verify and report software solutions using an adequate knowledge of current theories, models and techniques.
- IS6 – Ability to design appropriate solutions in one or more application domains using software engineering methods that include ethical, social, legal and economic aspects.

Degree Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.

- E3 – Ability to design, develop, evaluate and assure the accessibility, ergonomics, utility and security of the informatics systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms to develop and to run informatics systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E9 – Ability to solve problems with initiative, making decisions, autonomy and creativity. Ability to know how to communicate and transmit the knowledge, skills and abilities for the Technical Engineer in Informatics career.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Transversal or General Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T3 – Ability to use and apply ICT in the academic and professional field.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T8 – Ability to teamwork.

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.
- CB4 – Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Sistemas de Información Basados en Web – Web-based Information Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Business modelling. Integration with information systems. Technologies and web development frameworks. Web development methodologies. Techniques and models. Access databases from a website. Architectural patterns for web applications. Rich client development. Analysis of the website's usability.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Degree General Skills

- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E8 – To know about the basic subjects and technologies, which will prepare the student for the learning and development of new methods and technologies, as well as the ones which will give the student a great versatility to adapt themselves to new situations.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T6 – Ability to use and apply ICT in an academic and professional environment.

Sistemas Gráficos – Graphical Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Scene graphs. Web graphics systems. GPU programming. Large model processing. Medical applications.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB4 – Ability to develop, maintain and evaluate software services and systems that satisfy all user requirements and perform reliably and efficiently, are affordable to develop and maintain and meet quality standards, applying the theories, principles, methods and practices of Software Engineering.

Degree General Skills

- E3 – Ability to design, develop, evaluate and assure the accessibility, ergonomics, utility and security of the informatics systems, services and applications, as well as the information they manage.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E9 – Ability to solve problems with initiative, making decisions, autonomy and creativity. Ability to know how to communicate and transmit the knowledge, skills and abilities for the Technical Engineer in Informatics career.

Module Specific Skills

- B5 – Knowledge of the structure, organization, running and interconnection of the informatics systems, the principle of its programming, and its application to the problem solving typical of engineering.
- R6 – Knowledge and application of the basic algorithmic procedures of the informatics technologies to design solutions to problems – analysing the suitability and complexity of such algorithms.
- R7 – Knowledge, design and efficiently use of the most adequate data types and structures for solving a problem.
- R8 – Ability to analyse, design, build and maintain applications in a strong, secure and efficient way, choosing the most adequate paradigm and programming language.

Transversal Skills

- T1 – Ability to organise and plan as well as ability to manage Information.
- T3 – Ability to use and apply ICT in the academic and professional field.
- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

ESPECIALIDAD INGENIERÍA DE COMPUTADORES – SPECIALISATION IN COMPUTER ENGINEERING

Arquitectura de Sistemas – Systems Architecture

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Input/Output devices. Interrupts and exceptions. Controller design and programming. Hardware support and implementation of hardware-dependent system. Security and protection. Support of a computing platform for remote access to storage and other resources.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- T4 – Ability to communicate in a foreign language, particularly in English.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Arquitectura y Computación de Altas Prestaciones – High Performance Architectures and Computing

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Architectures for high performance computing. Parallel and distributed programming and interconnection networks for such architectures. Feature evaluation.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Degree Basic Skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Ability to organise and plan as well as ability to manage Information.

Desarrollo de Hardware Digital – Digital Hardware Development

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Methodologies for the design and construction of digital systems. Reconfigurable hardware and co-design platforms. Modelling and automatic synthesis with hardware description languages, verification. Development of specific processors, and interface and communication modules. Integration of specific computers systems, hardware/software co-design. Fields of application.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB1 - Students should have demonstrated to possess and understand knowledge in a study area which comes from the basis of general secondary education, and is usually found at a level that, while it is supported by advanced textbooks, it also includes some aspects that involve knowledge that comes from the forefront of their study field.

Diseño de Sistemas Electrónicos – Electronic Systems Design

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Integrated digital electronic systems: static and dynamic CMOS logic, static and dynamic memory elements, synchronisation of digital systems, self-timed circuits. Tools for describing and specifying electronic systems. Electrical, functional and temporal simulation tools.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- IC1 – Ability to design and build digital systems, including computers, microprocessor-based systems and communication systems.

Degree Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.

Transversal or General Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Ability to organise and plan as well as ability to manage Information.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.

- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T7 – Ability to communicate in a foreign language, particularly in English.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.
- T13 – Environmental responsibility.
- T14 – Respect for fundamental and equality rights.
- T15 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

Sistemas con Microprocesadores – Microprocessor-based Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Methodology for the design of microprocessor-based systems. Microcontroller architecture and programming. Sensors and actuators. Communication buses and interfaces. Applications design (control, mobile robots, etc.). Specialised microprocessor architecture.

GENERAL AND SPECIFIC SKILLS

Degree Specific Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills

- T2 – Organisation and planning skills as well as information management skills.

ESPECIALIDAD SISTEMAS DE INFORMACIÓN – SPECIALISATION IN INFORMATION SYSTEMS

Administración de Bases de Datos – Database Administration

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Database Management Systems.
- Physical database design.
- Database management and maintenance.

GENERAL AND SPECIFIC SKILLS

Degree Specific Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills

- T4 – Problem-solving skills.

Ingeniería de Sistemas de Información – Information System Engineering

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Information Systems Design. Data Modeling and Applications in Information Systems. Data Integration. Security and Standards in Information Systems.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

Programación Web – Web Programming

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Server-side programming. Client-side programming. User interaction. Web services. Web Information Systems.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal or General Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.

Sistemas de Información para Empresas – Business Information Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

International business standards. Enterprise Resource Planning (ERP) systems. Customer Relationship Management (CRM) systems. Supply Chain Management (SCM) systems. Enterprise applications and development platforms. E-commerce and e-business.

GENERAL AND SPECIFIC SKILLS

Degree Specific Skills

- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal or General Skills

- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.

Sistemas Multidimensionales – Multidimensional Database Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- OLAP systems.
- Searching in multidimensional database systems.
- Multidimensional Data Model.
- Multidimensional Design.
- Search processing and optimization.
- Systems Integration.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

ESPECIALIDAD TECNOLOGÍAS DE LA INFORMACIÓN – SPECIALISATION IN INFORMATION TECHNOLOGY

Computación Ubicua e Inteligencia Ambiental - Ubiquitous Computing and Ambient Intelligence

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Concept of Ubiquitous Computing. Concept of Ambient Intelligence. Management and exploitation of information from Sensor Networks. Computing Platforms in Ambient Intelligence environments (mobile device programming, mobile devices in ambient intelligence environments).

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.

Basic Skills

- CB1 - Students should have demonstrated to possess and understand knowledge in a study area which comes from the basis of general secondary education, and is usually found at a level that, while it is supported by advanced textbooks, it also includes some aspects that involve knowledge that comes from the forefront of their study field.
- CB2 – Students should be able to apply their knowledge to their work or vocation in a professional way, and possess the competences demonstrated through the development and defence of arguments and problem solving in their field of study.

Specific Skills

- TI1 – Ability to understand the environment of an organisation and its needs related to information and communication technologies.

Transversal Skills

- T3 – Ability to use and apply ICT in the academic and professional field.

Servidores Web de Altas Prestaciones – High Performance Web Servers

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Needs assessment. Hardware requirements for servers. Cost, quality and performance criteria. Server security. Performance (fault tolerance, high availability, etc.). Examples and applications.

GENERAL AND SPECIFIC SKILLS

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- T2 – Organisation and planning skills as well as information management skills.

Sistemas Multimedia – Multimedia Systems

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Introduction to Multimedia. Sound. Images and graphics. Video. Introduction to multimedia programming. Discrete media generation and processing. Continuous media playback and processing.

GENERAL AND SPECIFIC SKILLS

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- T3 – Ability to use and apply ICT in the academic and professional field.

Tecnologías Web – Web Technologies

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

HTTP protocol. Web description languages. WEB technologies: descriptive and generalized markup languages. Scripting languages. Dynamic page technologies. Web client and sever programming. Integration of information sources. Document analysis. Emerging technologies.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal Skills

- T3 – Ability to use and apply ICT in the academic and professional field.

Basic Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transmisión de Datos y Redes de Computadores – Data Communication and Computer Networks

ACADEMIC YEAR	SEMESTER	CREDITS
3º	6º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

User services, network management, network analysis and design, multimedia networks. Examples and applications.

GENERAL AND SPECIFIC SKILLS

Degree Specific Skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal Skills

- T2 – Organisation and planning skills as well as information management skills, ability to learn independently and entrepreneurial spirit.

Transmisión de Datos y Redes de Computadores (CEUTA) - Data Communication and Computer Networks (CEUTA)

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

User services, network management, network analysis and design, multimedia networks. Examples and applications.

GENERAL AND SPECIFIC SKILLS

Module Specific Skills

- TI1 – Ability to understand the environment of an organisation and its needs related to information and communication technologies.
- TI2 – Ability to select, design, deploy, integrate, evaluate, build, manage, operate and maintain hardware, software and network technologies, within appropriate cost and quality criteria.
- TI4 – Ability to select, design, deploy, integrate and manage networks and infrastructures in an organization.
- TI6 – Ability to design systems, applications and services based on network technologies, including the Internet, web, e-commerce, multimedia, interactive services and mobile computing.

Degree Specific Skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal Skills

- T2 – Organisation and planning skills as well as information management skills.
- T3 – Ability to use and apply ICT in the academic and professional field.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.

TRADUCCIÓN DE LA BREVE DESCRIPCIÓN Y COMPETENCIAS DE LAS ASIGNATURAS DE CUARTO CURSO DEL GRADO EN INGENIERÍA INFORMÁTICA

TRANSLATION OF THE BRIEF DESCRIPTION AND SKILLS OF THE SUBJECTS OF THE FOURTH ACADEMIC YEAR – BACHELOR'S DEGREE IN COMPUTER ENGINEERING

1º Semestre – 1º Semester

ESPECIALIDAD COMPUTACIÓN Y SISTEMAS INTELIGENTES – SPECIALISATION IN COMPUTATION AND INTELLIGENT SYSTEMS

Nuevos Paradigmas de Interacción – New Interaction Paradigms

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Interaction scenarios and paradigms. Gesture and movement-based interaction methods. Haptic interaction. Mobile devices interaction. Interaction in virtual reality environments. Dialogue systems. Voice interaction.

GENERAL AND SPECIFIC SKILLS
Subject Specific Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Degree Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.

Transversal or General Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T7 – Ability to communicate in a foreign language, particularly in English.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.
- T13 – Environmental responsibility.
- T14 – Respect for fundamental and equality rights.
- T15 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

Procesadores de Lenguajes – Language Processors

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Theoretical foundations of programming languages. Language Processor architecture. Analysis process (lexical, syntantic and semantic). Synthesis process (intermediate languages, memory organization and object code generation).

GENERAL AND SPECIFIC SKILLS

- C2 – Ability to understand the theoretical foundations of programming languages and the associated lexical, syntactic and semantic processing techniques, and know how to apply them to the creation, design and processing of languages.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.
- T15 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

Visión por Computador – Computer Vision

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Digital image processing. Pre-processing and feature extraction techniques. Motion estimation in images. Object detection. Applications.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T4 – Ability to communicate in a foreign language, particularly in English.

ESPECIALIDAD INGENIERÍA DEL SOFTWARE – SPECIALISATION IN SOFTWARE ENGINEERING

Desarrollo Basado en Agentes – Development of Agent-based Systems

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Agents as a paradigm in Software Engineering, concepts and typology.
- Agents' interaction and communication.
- Multi-agent systems.
- Multi-agent systems design.
- Multi-agent systems evolution.
- Agent-based solutions risks.
- Agent development methodologies.
- Standards.

- Applications.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Transversal Skills

- T3 – Ability to use and apply ICT in the academic and professional field.

Dirección y Gestión de Proyectos – Project Management

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Project management.
- Project planning and cost estimation.
- Risk estimation and management.
- Teamwork organization and management.
- Change management.
- Quality assurance.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Module Specific Skills

- IS1 – Ability to develop, maintain and evaluate software services and systems that satisfy all user requirements and perform reliably and efficiently, are affordable to develop and maintain and meet quality standards, applying the theories, principles, methods and practices of Software Engineering.
- IS5 – Ability to identify, assess and manage potential associated risk that may arise.

  Transversal Skills
- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T8 – Ability to teamwork.

Metodologías de Desarrollo Ágiles - Agile Development Methodologies

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

User-centred development. Agile Development Methodologies. Free software and companies. Development methodologies used in open-source software. Quality assessment techniques. Test-driven development.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

ESPECIALIDAD INGENIERÍA DE COMPUTADORES – SPECIALISATION IN COMPUTER ENGINEERING

Centros de Procesamiento de Datos – Data Centers

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

High-performance platform infrastructure. Configuration and integration. Input/output, interconnection and storage. Security. Regulations and standards. Administration, troubleshooting and performance evaluation.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.

Sistemas Empotrados – Embedded Systems

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Methodology and working tools for embedded systems. Platform and processor selection. System software and configuration. Driver development. Secure and critical systems for embedded applications. Multi-core systems.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Tecnologías de Red – Network Technologies

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Media access techniques, link control, local area networks, computer network design and administration, network security.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

ESPECIALIDAD SISTEMAS DE INFORMACIÓN – SPECIALISATION IN INFORMATION SYSTEMS

Bases de Datos Distribuidas – Distributed Database

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Distributed architectures. Logical and physical design of a distributed database. Distributed query processing. Administration and management of distributed database.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Basic Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Transversal or General Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

Inteligencia de Negocio – Business Intelligence

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Business Intelligence Tools. Data Warehousing. Data Mining.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.

Recuperación de la Información – Information Retrieval

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Information Retrieval Models. Indexing. XML Information Retrieval. Web Information Retrieval.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.

Transversal Skills

- T3 – Ability to use and apply ICT in the academic and professional field.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

ESPECIALIDAD TECNOLOGÍAS DE LA INFORMACIÓN – SPECIALISATION IN INFORMATION TECHNOLOGY

Desarrollo de Aplicaciones para Internet – Internet Applications Development

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Components development for web services. Advanced client-side applications: programming in web browsers, dynamic HTML. Frameworks.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- TI6 – Ability to design systems, applications and services based on network technologies, including the Internet, web, e-commerce, multimedia, interactive services and mobile computing.

Degree Specific Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal or General Skills

- T4 – Problem-solving skills.
- T8 – Ability to teamwork.

Infraestructura Virtual – Cloud Computing

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

The contents to be taught in this course are the following: comparing the virtual architecture with the digital architecture, and real with virtual data processing centers. The hardware used in servers and its virtualization will be discussed, as well as the difference between real and virtual storage and other computing resources.

It will be explained how the infrastructure fits in with the systems department and how it can be interlocked with the developers of a company. Finally, examples and applications will be shown.

GENERAL AND SPECIFIC SKILLS

Specific Skills

- TI1 – Ability to understand the environment of an organization and its needs related to information and communication technologies.
- TI2 – Ability to select, design, deploy, integrate, evaluate, build, manage, operate and maintain hardware, software and network technologies, within appropriate cost and quality criteria.
- TI6 – Ability to design systems, applications and services based on network technologies, including the Internet, web, e-commerce, multimedia, interactive services and mobile computing.

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.

Degree Specific Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal Skills

- T2 – Organisation and planning skills as well as information management skills.

Seguridad y Protección de Sistemas Informáticos - Security and Protection in Computer Systems

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Introduction to computer systems security. Protection methods.
- Basic and advanced cryptographic techniques.
- Cryptographic protocols and digital certificates.
- Security application: watermarking and e-commerce.
- Internet security: protocols and tools.
- Digital identity and biometric identification in computer systems.
- Applications and examples.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Specific Skills

- B1 – Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.
- B3 – Understanding and knowledge of the basis of discrete mathematics, logic, algorithmic and complex computing, and its application to the problem solving typical of engineering.

Transversal or General Skills

- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.

COMPLEMENTOS DE COMPUTACIÓN Y SISTEMAS INTELIGENTES - COMPUTER AND INTELLIGENT SYSTEMS COMPLEMENTS

Programación Técnica y Científica - Technical and Scientific Programming

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

High level tools and languages oriented to technical and scientific calculation. Graphical representation and data visualization. Prototyping and fast development of technical and scientific software. Engineering-specific software libreries. Solving common problems in Engineering. Communication and integration of software developed in different languages.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.

Simulación de Sistemas – System Simulation

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Discrete system simulation. Continuous system simulation. Hybrid system simulation. Monte Carlo methods. Data generators.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

Teoría de la Información y la Codificación – Information and Coding Theory

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Information theory. Entropy. Transmission systems. Detector and corrector codes.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

COMPLEMENTOS DE INGENIERÍA DEL SOFTWARE – SOFTWARE ENGINEERING COMPLEMENTS

Lógica y Programación – Logic and Programming

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Logic programming with Prolog.
- Lambda calculus.
- Combinatorial logic.
- Functional logic and programming.

GENERAL AND SPECIFIC SKILLS

General Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal or General Skills

- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.

Programación Gráfica de Videojuegos – Graphical Videogame Programming

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- 3D modelling of virtual environments.
- Simplification techniques.
- Indexing methods.
- Avatars.
- Frameworks for videogame programming.

GENERAL AND SPECIFIC SKILLS

Degree Specific Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal or General Skills

- T2 – Organisation and planning skills as well as information management skills.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.

Seguridad en Sistemas Operativos – Operating Systems Security

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Basic concepts of cybersecurity. Operating system security models and security auditing of operating systems. Basic concepts of ethical hacking. Forensic analysis of systems.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.

General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

COMPLEMENTOS DE INGENIERÍA DE COMPUTADORES – COMPUTER ENGINEERING COMPLEMENTS

Informática Industrial – Industrial Computing

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Control fundamentals. Quality measurement of a control system. Sequential control. Industrial sensors and actuators. Computer control. Distributed control. CIM concept. Industrial computers. Field buses and industrial networks. Elements of control centers. SCADA software. Examples of industrial process control. Domotics.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Tecnologías Emergentes – Emergent Technologies

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Hardware for weareable systems. Wireless sensor networks. Sensory rehabilitation systems. Implantable systems. Biomedical applications. Brain-machine interfaces. Technology compliance and certification.

GENERAL OR SPECIFIC SKILLS
Degree General Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

COMPLEMENTOS DE SISTEMAS DE INFORMACIÓN – INFORMATION SYSTEMS COMPLEMENTS

Gestión de Recursos Digitales – Digital Libreries

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Definition. Digital resources. Multimedia storage and retrieval. Metadata for digital libraries. Interoperability, standards and protocols. Modeling. Preservation of digital libraries. Usability.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.

Transversal Skills

- T3 – Ability to use and apply ICT in the academic and professional field.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Redes y Sistemas Complejos – Networks and Complex Systems

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Fundamentals of Graph Theory and Game Theory. Structural networks features. Networks models. Dynamic behaviour of complex systems. Applications. Social networks. Economic networks. Internet networks.

GENERAL AND SPECIFIC SKILLS

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.

Sistemas de Información Geográficos – Geographical Information Systems

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Raster model.
- Vector model.
- Spatial analysis.
- 3D GIS systems.
- Map servers.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- SI1 – Ability to integrate Information and Communication Technologies solutions and business processes to satisfy the information needs of organizations, enabling them to achieve their objectives effectively and efficiently, giving them competitive advantages.
- SI3 – Ability to actively participate in the specification, design, implementation and maintenance of information and communication systems.
- IS6 – Ability to design appropriate solutions in one or more application domains using software engineering methods that include ethical, social, legal and economic aspects.

Degree Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.

COMPLEMENTOS DE TECNOLOGÍAS DE LA INFORMACIÓN – INFORMATION TECHNOLOGY COMPLEMENTS

Compresión y Recuperación de Información Multimedia - Compression and Retrieval of Multimedia Information

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Multimedia compression bases. Lossless compression techniques. Lossy compression techniques. Multimedia compression standards. Multimedia information retrieval based on meta-information and content based.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.

Tratamiento de Imágenes Digitales – Digital Imaging Processing

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Digital image capture and formation. Operators for local and global digital image processing. Feature extraction. Digital image segmentation. Shape representing. Morphology. Colour image processing. Storage standards. Introduction to digital video processing. Image and video storage standards.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.

FORMACIÓN COMPLEMENTARIA INTERDISCIPLINAR – COMPLEMENTARY INTERDISCIPLINARY TRAINING

Creación de Empresas y Gestión Emprendedora - Business Creation and Enterprising Management

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Organization of the company creation process and conditioning factors.
- The figure of the entrepreneur.
- Responsible management and creativity in the organization of business activity.
- Entrepreneurship support programmes.
- Preparation of the Business Plan and viability analysis.
- Constitution and start-up of the business project.

GENERAL AND SPECIFIC SKILLS

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Derecho e Informática – Legal Informatics

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Introduction to Law. Constitutional principles and personality rights. Information Systems and Law. Personal data protection. E-commerce. Electronic administration. Intellectual and industrial property in the digital era. Computer crime.

GENERAL AND SPECIFIC SKILLS

Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T7 – Ability to communicate in a foreign language, particularly in English.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.
- T13 – Environmental responsibility.

- T14 – Respect for fundamental and equality rights. Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

Ética Informática y Sociedad de la Información - Computer Ethics and Information Society

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Concepts of ethics and ethical theories.
- Concept and implications of computer ethics.
- Concept of the Information Society.
- Computer ethics and social transformation.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.
- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T7 – Respect for fundamental and equality rights.
- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

2º Semestre – 2º Semester

PROYECTO FIN DE GRADO – BACHERLOR THESIS

Proyecto Fin de Grado – Bachelor Thesis

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	12

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

The Bachelor Thesis is an original exercise that must be carried out individually and must be presented and defended in front of the university examining board. The project consists of a professional study in the field of specific technologies of Computer Engineering, in which the students should demonstrate the competences acquired during the Degree.

GENERAL AND SPECIFIC SKILLS

Specific Skills

- PFG – Original exercise that must be carried out individually and must be presented and defended in front of the university examining board. The project consists of a professional study in the field of specific technologies of Computer Engineering, in which the students should demonstrate the competences acquired during the Degree.

Degree General Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Basic Skills

- CB1 – Students should have demonstrated to possess and understand knowledge in a study area which comes from the basis of general secondary education, and is usually found at a level that, while it is supported by advanced textbooks, it also includes some aspects that involve knowledge that comes from the forefront of their study field.
- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.
- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.
- CB4 – Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.
- T4 – Ability to communicate in a foreign language, particularly in English.

- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T7 – Respect for fundamental and equality rights.
- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

PRÁCTICAS DE EMPRESA – PROFESSIONAL INTERNSHIPS

Prácticas de Empresa – Professional Internships

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	12

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

The possibility of professional internships reinforces the commitment to the employability of future graduates, enriching their training in a professional environment that will provide them with a deeper knowledge of the competences they will need in the future.

Internships are assigned through the Centro de Promoción y Prácticas de Empresa (CPEP). Students interested in doing an internship must sign up on the ICARO platform, where they will fill in their profile and preferences. Companies interested will contact the students through the platform. Students will be selected after an interview.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Basic Skills

- CB1 – Students should have demonstrated to possess and understand knowledge in a study area which comes from the basis of general secondary education, and is usually found at a level that, while it is supported by advanced textbooks, it also includes some aspects that involve knowledge that comes from the forefront of their study field.
- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.
- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.
- CB4 – Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.
- T4 – Ability to communicate in a foreign language, particularly in English.
- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T7 – Respect for fundamental and equality rights.
- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

COMPLEMENTOS DE COMPUTACIÓN Y SISTEMAS INTELIGENTES - COMPUTER AND INTELLIGENT SYSTEMS COMPLEMENTS

Criptografía y Computación – Criptography and Computing

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Introduction to cryptography: description, problems and methods. Classical cryptography. Computational paradigms in cryptography: algorithms and complexity. Multiple-precision integer and modular arithmetic. Efficient implementation. Secret-key cryptography. Public-key cryptography. Algorithm attacks. Brute-force attack. Calculation capacity. Cryptographic protocols and applications.

GENERAL AND SPECIFIC SKILLS
Basic and General Skills

- CB4 – Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.

Programación Lúdica – Ludic Programming

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Programming languages. Programming libraries and specific development software. Design and implementation of physical systems. Multiplayer and network games. Artificial intelligence in games. Search algorithms. Intelligent agents.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Basic Skills

- CB1 – Students should have demonstrated to possess and understand knowledge in a study area which comes from the basis of general secondary education, and is usually found at a level that, while it is supported by advanced textbooks, it also includes some aspects that involve knowledge that comes from the forefront of their study field.
- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.

Specific Skills

- C4 – Ability to understand the fundamentals, paradigms and techniques of intelligent systems and to analyse, design and build systems, services and computer applications that use these techniques in any field of application.

Transversal Skills

- T3 – Ability to use and apply ICT in the academic and professional field.

Robótica Industrial – Industrial Robotic

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Manipulator kinematics and dynamics, trajectory design and control, manipulator programming, vision subsystems and interaction with the environment.

GENERAL AND SPECIFIC SKILLS

Module Specific Skills

- C1 – Ability to deeply understand the fundamental principles and models of computation, and to apply them to interpret, select, evaluate, model and create new concepts, theories, uses and technological developmens related to computing.
- C4 – Ability to understand the fundamentals, paradigms and techniques of intelligent systems and to analyse, design and build systems, services and computer applications that use these techniques in any field of application.

Degree Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Transversal Skills

- T1 – Organisation and planning skills as well as information management skills.
- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Ability to use and apply ICT in the academic and professional field.
- T4 – Ability to communicate in a foreign language, particularly in English.
- T5 – Ability to teamwork – using showable skills through the creation and defence of arguments.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T7 – Respect for fundamental and equality rights.
- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

COMPLEMENTOS DE INGENIERÍA DEL SOFTWARE – SOFTWARE ENGINEERING COMPLEMENTS

Animación por Ordenador – Computer Animation

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Computer animation: animation process.
- Animation techniques.
- Movement curves.
- Procedural animation.
- Animation controllers. Behaviours.
- Skeleton techniques.
- Motion capture.
- Character animation. Crowds.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- IS6 – Ability to design appropriate solutions in one or more application domains using software engineering methods that include ethical, social, legal and economic aspects.

Degree Specific Skills

- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal or General Skills

- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.

- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.
- T15 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

Nuevas Tecnologías de la Programación – New Programming Technologies

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Advanced programming techniques: functional programming, design patterns, applications.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB2 – Students should know how to professionally apply their knowledge to their work or career and have the skills that are usually demonstrated through the elaboration and defence of arguments and problem solving within their study area.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Programación Paralela – Parallel Programming

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Parallel systems and parallel programming models. Methodology for parallel algorithms design. Parallel algorithms analysis. Parallel algorithmic schemes. Parallel programming languages and libraries.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB1 – Students should have demonstrated to possess and understand knowledge in a study area which comes from the basis of general secondary education, and is usually found at a level that, while it is supported by advanced textbooks, it also includes some aspects that involve knowledge that comes from the forefront of their study field.

COMPLEMENTOS DE INGENIERÍA DE COMPUTADORES – COMPUTER ENGINEERING COMPLEMENTS

Circuitos Integrados e Impresos – Electronic Systems Design

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Integrated circuit manufacturing technology: wafer fabrication, planar silicon technology, CMOS process sequence, special and emerging technologies (BiCMOS, SOI), memory fabrication. Design methodologies and tools for describing integrated circuits: full-custom design, physical design rules, parasitic element extraction, semi-custom design. Printed circuit board manufacturing technology: substrated, conductors, soldering. Printed circuit design rules: electromagnetic compatibility, power supply. Printed circuit board design tools: design flows, routing.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

Mantenimiento de Equipos Informáticos – Computer Equipment Maintenance

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

PC maintenance: environmental factors, vibration and shocks, acoustic noise, electromagnetic and radio-frequency interference, electrostatic discharge, reliability notions, microprocessor (packages, sockets, power supply, clock signal frequency, electromagnetic compatibility), motherboard (chipsets, power supply, format), failures and maintenance.

Storage systems: magnetic magnetic and optical disks, recording formats, disk interface controllers, failures and maintenance.

Power supply: power supply, power supply problems: causes, effects, Uninterruptible Power Supplies (UPS), dissipation, ventilation and cooling.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- TI2 – Ability to select, design, deploy, integrate, evaluate, build, manage, operate and maintain hardware, software and network technologies, within appropriate cost and quality criteria.

Degree Specific Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.

Transversal or General Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T7 – Ability to communicate in a foreign language, particularly in English.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.
- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.

COMPLEMENTOS DE SISTEMAS DE INFORMACIÓN – INFORMATION SYSTEMS COMPLEMENTS

Periféricos y Dispositivos de Interfaz Humana - Peripherals and Human Interface Devices

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Peripherals for mass storage.
- Input transducers.
- Conventional input devices.
- Conventional output devices.
- Multimedia peripherals.
- Virtual reality peripherals.
- Human-computer interaction in new environments peripherals.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Basic Skills

- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Sistemas Cooperativos y Gestión de Contenidos - Cooperative Systems and Content Management

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Cooperation concepts, collective interaction and e-administration.
- Tools for the development of cooperative portals: CMS and development frameworks.
- Evolutionary development based on parameterization and metamodels.

- Methodologies applied to the development of cooperative systems. Technologies for the development of cooperative systems.
- Social implications of cooperative systems.

GENERAL AND SPECIFIC SKILLS
Degree General Skills

- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Subject Specific Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.
- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal or General Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.

COMPLEMENTOS DE TECNOLOGÍAS DE LA INFORMACIÓN – INFORMATION TECHNOLOGY COMPLEMENTS

Procesamiento Digital de Señales – Digital Signal Processing

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Spectral analysis of signals. Discrete systems: time and transformed domains. Digital filters. Applications in communications, audio, voice, images and video.

GENERAL AND SPECIFIC SKILLS

General Skills

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Module Specific Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

Programación de Dispositivos Móviles – Mobile Device Programming

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Mobile device programming: operating systems for mobile devices. Development environments (SDK). Graphics and event management services. Application structure.

GENERAL AND SPECIFIC SKILLS

Subject Specific Skills

- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.

Degree Specific Skills

- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.

Transversal or General Skills

- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.

Redes Multiservicio – Multiservice Networks

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)
Voice and data networks. Multimedia networks. QoS. Real-time networks. IPv6. Cellular networks. Mobile internet. Next generation internet.

GENERAL AND SPECIFIC SKILLS
General Skills

- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.

FORMACIÓN COMPLEMENTARIA INTERDISCIPLINAR – COMPLEMENTARY INTERDISCIPLINARY TRAINING

Creación de Empresas y Gestión Emprendedora - Business Creation and Enterprising Management

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Organization of the company creation process and conditioning factors.
- The figure of the entrepreneur.
- Responsible management and creativity in the organization of business activity.
- Entrepreneurship support programmes.
- Preparation of the Business Plan and viability analysis.
- Constitution and start-up of the business project.

GENERAL AND SPECIFIC SKILLS

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E9 – Ability for ethical and sustainable development of a business and economic entity.
- E11 – Ability to analyse and assess the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of a Technical Engineer in Computer Science.
- E12 – Knowledge and application of basic elements of economics and human resources management, project organisation and planning, as well as the legislation, regulation and standardisation in the field of IT projects, according to the knowledge acquired.

Derecho e Informática – Legal Informatics

ACADEMIC YEAR	SEMESTER	CREDITS
4º	8º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

Introduction to Law. Constitutional principles and personality rights. Information Systems and Law. Personal data protection. E-commerce. Electronic administration. Intellectual and industrial property in the digital era. Computer crime.

GENERAL AND SPECIFIC SKILLS

Specific Skills

- E1 – Ability to create, write, organise, plan, develop and sign projects in the Informatics Engineering field that have as aim, according to the acquired knowledge, conception, development or exploitation of informatics systems, services and applications.
- E2 – Ability to manage the main objectives of projects from the Informatics field according to the acquitted knowledge.
- E3 – Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as the information they manage.

- E4 – Ability to define, evaluate and select hardware and software platforms for the development and implementation of computer systems, services and applications.
- E5 – Ability to create, develop and maintain informatics systems, services and applications using software engineering methods as tools to assure the quality.
- E6 – Ability to create and develop informatics systems or architecture centralised or distribuend integrating hardware, software and networks.
- E7 – Ability to know, understand and apply the necessary legislation during the development of the Technical Engineer career in Informatics, and to manage specifications, regulations and norms of obligatory compliance.
- E8 – Knowledge of basic subjects and technologies, which enable students to learn and develop new methods and technologies, as well as those which provide them with a great versatility to adapt to new situations.
- E9 – Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit the knowledge, abilities and skills of the profession of Technical Engineer in Computer Science.
- E10 – Knowledge to make measurements, calculations, valuations, assessments, expert's reports, studies, reports, task planning and other analogue jobs of Informatics.
- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.
- E12 – Knowledge and application of the basis in economy and human resources management, organization and project planning; as well as the legislation, regulation and normalisation in the Informatics projects field, according to the acquired knowledge.

Transversal Skills

- T1 – Capacity for analysis and synthesis: finding, analysing, criticising (critical reasoning), relating, structuring and synthesising information from different sources, as well as integrating ideas and knowledge.
- T2 – Organisation and planning skills as well as information management skills.
- T3 – Oral and written communication skills in an academic and professional environment, especially in writing technical documentation.
- T4 – Problem-solving skills.
- T5 – Ability to make decisions based on objective criteria (available experimental, scientific or simulation data) as well as the ability to logically argue and justify such decisions and the ability to accept other points of view.
- T6 – Ability to use and apply ICT in an academic and professional environment.
- T7 – Ability to communicate in a foreign language, particularly in English.
- T8 – Ability to teamwork.
- T9 – Ability to learn independently, as well as initiative and entrepreneurial spirit.

- T10 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T11 – Ability to adapt to technologies and future environments updating professional skills.
- T12 – Ability to innovate and create new ideas.
- T13 – Environmental responsibility.
- T14 – Respect for fundamental and equality rights. Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.

Ética Informática y Sociedad de la Información - Computer Ethics and Information Society

ACADEMIC YEAR	SEMESTER	CREDITS
4º	7º	6

BRIEF DESCRIPTION OF CONTENTS (ACCORDING TO THE DEGREE VERIFICATION REPORT)

- Concepts of ethics and ethical theories.
- Concept and implications of computer ethics.
- Concept of the Information Society.
- Computer ethics and social transformation.

GENERAL AND SPECIFIC SKILLS

Degree General Skills

- E11 – Ability to analyse and value the social and environmental impact of technical solutions, understanding the ethical and professional responsibility of the Technical Engineer in Computer Science.

Basic Skills

- CB3 – Students should have the ability to gather and interpret relevant datum (usually from their study area) to make judgments that include a reflection on relevant topics of an ethical, scientific or social nature.
- CB4 - Students should be able to communicate information, ideas, problems and solutions to a specialised or general audience.
- CB5 – Students should have developed the necessary learning skills to keep their future studies with a great degree of autonomy.

Transversal Skills

- T2 – Ability to make decisions based on objective criteria (available datum a such as experimental, scientific or of simulation one) as well as ability to argue and logically justify such decisions, knowing how to accept other points of view.
- T6 – Motivation for quality and continuous improvement, acting with rigour, responsibility and professional ethics.
- T7 – Respect for fundamental and equality rights.
- T8 – Ability to project knowledge, skills and abilities acquired to promote a society based on the values of freedom, justice, equality and pluralism.