

SCHOOL OF ENGINEERING

New 4-year EHEA Degree on Computer Science (Information Systems)

All courses taught in Spanish

1st year			
Autumn semester	ECTS	Spring semester	ECTS
Fundamentals of Programming	6	Object Oriented Programming	6
Physics	6	Computer Architecture	6
Digital Systems	6	Algebra	6
Statistics	6	Mathematics Methods for Engineering	6
Calculus	6	Business Organisation and Management	6

2nd Year			
Autumn semester	ECTS	Spring semester	ECTS
Databases Design	6	Databases Architecture	6
Data Structures	6	Operating Systems	6
Algorithms I	6	Algorithms II	6
Software Engineering I	6	Software Engineering II	6
Computer Networks	6	Fundamentals of Information Systems	6

3rd Year			
Autumn semester	ECTS	Spring semester	ECTS
Database Management	6	Systems Integration	6
Advanced Programming	6	Project Engineering	6
Distributed Systems	6	Business Process Management	6
Information Systems Technologies	6	Elective I	6
Security in Information Systems	6	Elective II	6

4th Year			
Autumn semester	ECTS	Spring semester	ECTS
Project Planning and Management	6	Business Intelligence	6
Quality in Software	6	Elective III	6
Artificial Intelligence	6	Elective IV	6
Information Systems Management	6	Elective V	6
Final Degree Project			12

Elective Studies (min 30 ECTS)	ECTS	Elective Studies (min 30 ECTS)	ECTS
Data Mining	6	Operational Research	6
Audit of Information Systems	6	Symbolic logic	6
Ubiquitous Computing	6	Advanced Development Technologies	6
Real-Time Information Systems	6	Wireless Communications	6
e-Administration	6	Systems Optimization	6
Formal methods	6	Compiler Construction	6
Computer Vision and Robotics	6	Bioinformatics	6
Entrepreneurship	6		

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1st Year

701001	Fundamentals of Programming <i>(Fundamentos de Programación)</i>	Credits:	6 ECTS
Year:	1st	Semester:	Autum
Pre-requisites:	None		
Responsible:	Dr. Alicia Troncoso (ali@upo.es)		
Contents:			
<i>Programming Fundamentals. Basic Data Types. Control Structures. Algorithm design.</i>			

701002	Physics for Computer Science <i>(Fundamentos Físicos de la Informática)</i>	Credits:	6 ECTS
Year:	1st	Semester:	Autumn
Pre-requisites:	None		
Responsible:	Dr. Carmen Gordillo (cgorbar@upo.es)		
Contents:			
<i>Electric and Magnetic Fields. Electromagnetic waves. AC/DC circuits. Semiconductors and solid-state devices.</i>			

701003	Digital Systems <i>(Sistemas Digitales)</i>	Credits:	6 ECTS
Year:	1st	Semester:	Autumn
Pre-requisites:	None		
Responsible:	Dr. Luis Merino (lmercab@upo.es)		
Contents:			
<i>Binary representation of information. Binary arithmetic. Boolean algebra and logic gates. Design of combinational and sequential digital systems. Memory components and hierarchy. Arithmetic-Logic Units. CPUs.</i>			

701004	Algebra <i>(Álgebra)</i>	Credits:	6 ECTS
Year:	1st	Semester:	Spring
Pre-requisites:	None		
Responsible:	Dr. Sergio Bermudo (sbernav@upo.es)		
Contents:			
<i>Matrices. Systems of equations. Vector Spaces. Lineal applications. Orthogonality and Least Squares. Eigenvalues and eigenvectors. Quadratic Forms.</i>			

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701005	Calculus (Cálculo)	Credits:	6 ECTS
Year:	1st	Semester:	Autumn
Pre-requisites:	None		
Responsible:	Dr. Sergio Bermudo (sbernav@upo.es)		
Contents:			
<i>Series. Continuity of functions of several variables Differentiability of functions of several variables. Classical Optimization. Integral Calculus. Introduction to differential equations</i>			

701006	Object Oriented Programming (Programación Orientada a Objetos)	Credits:	6 ECTS
Year:	1st	Semester:	Spring
Pre-requisites:	Recommended Fundamentals of Programming		
Responsible:	Dr. Raúl Giráldez (giraldez@upo.es)		
Contents:			
<i>Introduction to Object Oriented Programming. The Java Language. Classes and Objects. Inheritance and polymorphism. Standard libraries</i>			

701007	Computer Architecture (Fundamentos de Computadores)	Credits:	6 ECTS
Year:	1st	Semester:	Spring
Pre-requisites:	Recommended Digital Systems		
Responsible:	Dr. Manuel Béjar (mbejdom@upo.es)		
Contents:			
<i>Basic Architecture of a Computer System. Direction modes and Instruction Set Architecture. Stacks. Subroutines. Chronograms. Exceptions. Peripherals. Advanced and new concepts on computer architecture.</i>			

701008	Statistics (Estadística)	Credits:	6 ECTS
Year:	1st	Semester:	Autumn
Pre-requisites:	None		
Responsible:	Dr. Beatriz Hernández (mbherjim@upo.es)		
Contents:			
<i>Descriptive statistics. Probability. Random variables and probability distributions. Statistical Inference. Hypothesis testing.</i>			

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701009	Mathematics Methods for Engineering <i>(Métodos Matemáticos para la Ingeniería)</i>	Credits:	6 ECTS
Year:	1st	Semester:	Spring
Pre-requisites:	<i>Recommended Algebra and Calculus</i>		
Responsible:	<i>Dr. Ángel Tenorio (aftenorio@upo.es)</i>		
Contents:			
<i>Error theory. Numerical solving of equations. Numerical solution of systems of equations. Function approximation. Numeric derivation and integration. Numeric solving of differential equations.</i>			

701010	Business Organization and Management <i>(Organización y Gestión de Empresas)</i>	Credits:	6 ECTS
Year:	1st	Semester:	Spring
Pre-requisites:	<i>None</i>		
Responsible:	<i>Dr. Elena Sousa (esougin@upo.es)</i>		
Contents:			
<i>Business Fundamentals. Objectives and Planning. Management Design. Operations direction. Marketing Direction. Financial Direction. Human Resources.</i>			

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Second Year

701011	Databases Design <i>(Diseño de Bases de Datos)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Autumn
Pre-requisites:	None		
Responsible:	<i>Dr. Domingo Rodríguez (dsrodbae@upo.es)</i>		
Contents:			
<i>Introduction to databases. Databases models. The entity/relation model. The relational model. Relational Algebra and Calculus. Database normalization. Additional data models.</i>			

701012	Data Structures <i>(Estructuras de Datos)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Autumn
Pre-requisites:	<i>Recommended Fundamentals of Programming and OOP</i>		
Responsible:	<i>Dr. Federico Divina (fdivina@upo.es)</i>		
Contents:			
<i>Java Collection Framework. Lists. Sets and Sorted Sets. Design and implementation of Data Structures</i>			

701015	Algorithms I <i>(Algorítmica I)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Autumn
Pre-requisites:	None		
Responsible:	<i>Dr. Miguel García (mgarcia@upo.es)</i>		
Contents:			
<i>Elemental algorithmic. Algorithmic complexity. Algorithm analysis. Greedy Algorithms. Divide and conquer. Dynamic programming. Backtracking.</i>			

701013	Software Engineering I <i>(Ingeniería del Software I)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Autumn
Pre-requisites:	None		
Responsible:	<i>Dr. Roberto Ruiz (robertoruiz@upo.es)</i>		
Contents:			
<i>Introduction to the Software development process. Requirements analysis. Systems specifications by using UML. Use cases. Software systems design. OO Design with UML. Design patterns. Introduction to software testing and maintenance.</i>			

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701014	Fundamentals of Information Systems <i>(Fundamentos de Sistemas de Información)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Spring
Pre-requisites:	None		
Responsible:	<i>Dr. Carlos Barranco (cbarranco@upo.es)</i>		
Contents:			
<i>Introduction to Enterprise information systems. Architecture of information systems. Basic Information Systems Management. Parameterization of Information Systems</i>			

701016	Databases Architecture <i>(Arquitectura de Bases de Datos)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Spring
Pre-requisites:	<i>Recommended Databases Design</i>		
Responsible:	<i>Dr. Domingo Rodríguez (dsrodbae@upo.es)</i>		
Contents:			
<i>Physical design of databases. Concurrency management. Indexing. Query execution.</i>			

701018	Operating Systems <i>(Sistemas Operativos)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Spring
Pre-requisites:	None		
Responsible:	<i>Dr. Federico Divina (fdivina@upo.es)</i>		
Contents:			
<i>Introduction to Operating Systems. Processes and tasks. Memory management. Input/Output management. File systems.</i>			

701049	Algorithms II <i>(Algorítmica II)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Spring
Pre-requisites:	<i>Recommended Algorithms I</i>		
Responsible:	<i>Dr. Miguel García (mgarcia@upo.es)</i>		
Contents:			
<i>Lists. Stacks and Queues. Trees and algorithms based on trees. Sets. Graphs and algorithms based on graphs.</i>			

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701017	Software Engineering II <i>(Ingeniería del Software II)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Spring
Pre-requisites:	<i>Recommended Software Engineering I</i>		
Responsible:	<i>Dr. Norberto Díaz (ndiaz@upo.es)</i>		
Contents:			
<i>Planning and Analysis of the Software Development Process. Architectural Software Design. The Unified Development Process.</i>			

701019	Computer Networks <i>(Redes de Computadores)</i>	Credits:	6 ECTS
Year:	2nd	Semester:	Autumn
Pre-requisites:	<i>None</i>		
Responsible:	<i>Dr. Luis Merino (lmercab@upo.es)</i>		
Contents:			
<i>Introduction to computer networks. Reference Models. Network elements. The Physical Layer: Data transmission. The Link Layer and Medium Access Control Sublayer. The Network Layer. Local Area Networks. The Transport Layer.</i>			

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Third Year

701020	Databases Maintenance <i>(Mantenimiento de Bases de Datos)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Autumn
Pre-requisites:	<i>Recommended Databases Design and Architecture</i>		
Responsible:	<i>Dr. Domingo Rodríguez (dsrodbae@upo.es)</i>		
Contents:	<p><i>Advanced Architectures: optimization, execution planning, cost estimation. Failure management: recovery, undo and redo logging, backups.</i></p> <p><i>Database Tuning: concurrency control, recovery and logging, indexes, hardware, operating system.</i></p> <p><i>Database management systems for Web. NoSql model. Differences with respect to the relational model. Classification of NoSql models.</i></p>		
701021	Advanced Programming <i>(Programación Avanzada)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Autumn
Pre-requisites:	<i>Recommended Fundamentals of Programming and OOP, as well as Data Structures</i>		
Responsible:	<i>Dr. Carlos D. Barranco (cbarranco@upo.es)</i>		
Contents:	<p><i>Hypertext Markup Language (HTML). Cascade Style Sheets (CSS). The PHP language. Interactive web pages. Web site design and usability. Mobile applications.</i></p>		
701022	Distributed Systems <i>(Sistemas Distribuidos)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Autumn
Pre-requisites:	<i>Recommended Computer Networks and Operating Systems</i>		
Responsible:	<i>Dr. Federico Divina (fdivina@upo.es)</i>		
Contents:	<p><i>Introduction to Distributed Systems. Architectures. Processes. Communication. Naming. Synchronization. Distributed File Systems</i></p>		

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701023	Information Systems Technologies <i>(Tecnologías de Sistemas de Información)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Autumn
Pre-requisites:	None		
Responsible:	Dr. Norberto Díaz (ndiaz@upo.es)		
Contents:			
<i>Information Systems Maintenance. Development of Information Systems. Other tendencies on Information Systems (OLAP, Management Information Systems)</i>			

701024	Business Process Management <i>(Gestión de Procesos de Negocio)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Spring
Pre-requisites:	<i>Recommended Fundamentals of Information Systems (introductory course on Information Systems) and a basic course on Business Organization</i>		
Responsible:	Dr. Domingo Savio Rodríguez Baena (dsrodbae@upo.es)		
Contents:			
<i>Introduction to Business Processes. Business Processes Management Systems: definition, evolution, languages, technologies. Business Processes Models: BPMN vs UML2. Standard BPMN.</i>			

701025	Systems Integration (Integración de Tecnologías)	Credits:	6 ECTS
Year:	3rd	Semester:	Spring
Pre-requisites:	<i>Databases Management, Advanced Programming</i>		
Responsible:	Dr. Carlos D. Barranco (cbarranco@upo.es)		
Contents:			
<i>Development using integrated architectures. Database integration technologies. High-performance databases. Heterogeneous systems integration. Rapid development of integrated systems</i>			

701026	Project Engineering <i>(Ingeniería de Proyectos)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Spring
Pre-requisites:	<i>Software Engineering II</i>		
Responsible:	Francisco A. Gómez (fgomez@upo.es)		
Contents:			
<i>Introduction to Project Engineering and Management. Legal aspects. Business Plans. Project Planning. Project execution. Project Management, Control and supervision.</i>			

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701027	Security in Information Systems <i>(Seguridad en Sistemas de Información)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Autumn
Pre-requisites:	None		
Responsible:	Eloy Sanz (eloy@eloy sanz.com)		
Contents:			
<i>Fundamentals of Security. Risk Analysis and Management. The security cycle and security policies. Physical security. Network security. Access control. Secure development of software. Cryptography. Security management. Availability.</i>			

701034	Data Mining <i>(Minería de Datos)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Spring
Pre-requisites:	Elective		
Responsible:	Dr. Jesús Aguilar (aguilar@upo.es)		
Contents:			
<i>Introduction to KDD (Knowledge Discovery from Data), Pre-processing techniques. Feature selection methods. Clustering. Classification and regression. Validation techniques. Evolutionary Algorithms.</i>			

701035	Real-Time Information Systems <i>(Sistemas de Información en Tiempo Real)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Spring
Pre-requisites:	Elective		
Responsible:	Dr. Manuel Béjar (mbejdom@upo.es)		
Contents:			
<i>Real-time software systems. Concurrency. Asynchronous notification. POSIX systems. Parallel computing: CUDA</i>			

701035	Bioinformatics <i>(Bioinformática)</i>	Credits:	6 ECTS
Year:	3rd	Semester:	Spring
Pre-requisites:	Elective		
Responsible:	Dr. Norberto Díaz (ndiaz@upo.es)		
Contents:			
<i>Basic concepts. Classical algorithms. Biologic knowledge extraction and validation. Genomics. Proteomics. New Challenges.</i>			

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Fourth Year

Name:	Business Intelligence <i>(Inteligencia de Negocio)</i>	Credits:	6 ECTS
Year:	4th	Semester:	Spring
Pre-requisites:	<i>Recommended Data Mining</i>		
Responsible:	<i>Dr. Miguel García (mgarcia@upo.es)</i>		
Contents:	<i>ETL, OLAP, Data Mining, Big Data</i>		

Name:	Project Planning and Management <i>(Planificación de Proyectos)</i>	Credits:	6 ECTS
Year:	4th	Semester:	Autumn
Pre-requisites:	<i>Project Engineering, Software Engineering courses</i>		
Responsible:	<i>Fco. Javier Gil Cumbreiras (fgilcum@upo.es)</i>		
Contents:	<i>Introduction to Software Project Management. Development and execution management. Execution monitoring. Risk management. Project delivery.</i>		

Name:	Quality in Software <i>(Calidad)</i>	Credits:	6 ECTS
Year:	4th	Semester:	Autumn
Pre-requisites:			
Responsible:			
Contents:	<i>Evaluation and improvement models for software development processes. Quality evaluation of software products. Certification. Regulations and Standards.</i>		

Name:	Artificial Intelligence <i>(Inteligencia Artificial)</i>	Credits:	6 ECTS
Year:	4th	Semester:	Autumn
Pre-requisites:	<i>Recommended Algorithmic I and II</i>		
Responsible:	<i>Alicia Troncoso Lora (ali@upo.es)</i>		
Contents:	<i>Problem representation and heuristics. Heuristic search. Learning. Knowledge extraction and representation</i>		

Name:	Information Systems Management <i>(Gestión de Sistemas de</i>	Credits:	6 ECTS
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	<i>Información</i>		
Year:	4th	Semester:	Autumn
Pre-requisites:	<i>Recommended Information Systems Technologies</i>		
Responsible:	<i>Francisco Javier Duque Pintor (fjduqpin@upo.es)</i>		
Contents:			
<i>Information Systems and IT Services. Services Strategy. Service Design. Service Operation. Service Management Certification.</i>			

Name:	Entrepreneurship (Creación de Empresas)	Credits:	6 ECTS
Year:	4 th (Elective)	Semester:	Spring
Pre-requisites:			
Responsible:	<i>Dr. Jesús Aguilar Ruiz (aguilar@upo.es)</i>		
Contents:			
<i>The entrepreneur. Elaboration of business plans. Legal aspects. Financial and economic decisions. Human resources. Business strategy. Funding.</i>			

Name:	Audit of Information Systems (Auditoría de Sistemas de Información)	Credits:	6 ECTS
Year:	4 th (Elective)	Semester:	Spring
Pre-requisites:	<i>Recommended Project Engineering</i>		
Responsible:	<i>David de Vega Rodríguez (ddevega@upo.es)</i>		
Contents:			
<i>Audit of Information Systems. Audit Reporting. Audit Methodologies and Tools. Planning. Security Audit. Quality Audit.</i>			

Name:	e-Administration (Administración Electrónica)	Credits:	6 ECTS
Year:	4 th (Elective)	Semester:	Spring
Pre-requisites:	<i>Recommended Security in Information Systems</i>		
Responsible:	<i>Francisco Javier Duque Pintor (fjduqpin@upo.es)</i>		
Contents:			
<i>Introduction to e-Administration. Electronic Certificates and IDs. IT initiatives within the e-Administration. Personal information. National Security Framework. Open Data.</i>			

Name:	Robotics and Computer Vision (Robótica y Visión Artificial)	Credits:	6 ECTS
Year:	4 th (Elective)	Semester:	Spring
Pre-requisites:			

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Responsible:	<i>Dr. Luis Merino (lmercab@upo.es)</i>
Contents:	<i>Fundamentals of Computer Vision. Low-level vision. Tracking and Recognition. Fundamentals of Robotics. Localization and Mapping. Navigation. ROS. OpenCV</i>

Name:	Advanced Development Technologies <i>(Tecnologías Avanzadas de Desarrollo)</i>	Credits:	6 ECTS
Year:	4 th <i>(Elective)</i>	Semester:	Spring
Pre-requisites:	<i>Recommended Advanced Programming</i>		
Responsible:			
Contents:	<i>Development of interfaces. Advanced programming methodologies (mobile, etc.). Advanced access and processing of data Banks.</i>		