University of Leon

Graduate in Computer Engineering

Memorandum

School of Industrial and Computer Engineering

2009

Contents

1 Description of the Qualification

1.1 Name of the Qualification

- Graduate in Computer Engineering of the University of Leon

1.2 Requesting University and Department

- University of Leon
- School of Industrial and Computer Engineering

1.3 Address for Correspondence

Vicerrectorado de Ordenación Académica
Paseo de la Facultad, 25
24071 León
Spain
recvoa@unileon.es Tel.: +34 987 291629; Fax.: +34 987 291614

1.4 Representative of the University

José Ángel Hermida Alonso; Post: *Rector* [Vice-Chancellor]

1.5 Contact Person for the Qualification

Ángel Alonso Álvarez; Post: Director of the School of Industrial and Computer Engineering

1.6 Type of Instruction

- With attendance

The type of instruction for this qualification is deemed to be "with attendance", even though 5% of the instructional activities in which teaching staff participate are timetabled as not requiring attendance.

1.7 Number of Places Available per Year's Intake

- One hundred places will be available for each fresh year's intake of students.

This degree is proposed as a reworking of the course leading to the qualification of Computer Engineer, currently taught at the University of Leon.

Over the last five years the average enrolment for that qualification was 90 students.

1.8 Number of Credits and Enrolment Requirements

NUMBER OF CREDITS

- The proposed degree will comprise 240 ECTS credits.

ENROLMENT REQUIREMENTS

- In view of the provisions of the Decree Regulating Public Sector Fees in the Autonomous Community of Castile and Leon, both those students registering for first-semester subjects and those who are re-enrolling and registering for second-semester subjects may enrol in whatever subjects from those semesters they consider appropriate.

NORMS FOR CONTINUED GOOD STANDING

- Article 128 of the Statutes of the University of Leon lays down that the *Consejo Social* [Social Board] of the University, at the proposal of the *Consejo de Gobierno* [Governing Body] on the basis of a prior report from the *Consejo de Coordinación Universitaria* [University Co-ordination Board], shall fix the maximum number of attempts that a student may be permitted in order to pass the examinations for a subject and the maximum periods for which students may remain registered in good standing for courses taught by the University and leading to qualifications issued by it, in accordance with the nature of the relevant programme of studies. As the provisions of this Article have not yet been activated, the current regulations governing these matters are those established by Spanish Royal Decree-Law 8/1976, of 16 June 1976, Resolutions of the *Junta* [Standing Committee] or the Governing Body, and decisions the Vice-Chancellor, which together stipulate the following:
    - Students in their first year who pass no subjects in the official examination session shall not be permitted to continue the course of studies leading to the qualification for which they enrolled. If this recurs in any new

department to which they then may have transferred, they shall not be permitted to continue with any further University course of studies.

- In courses of studies for which there is a limitation on the number of places on offer, and for which at the end of the admissions procedure it is found that there are still places available, appropriate authorization shall also be required.
- Those students who have failed any subject in six separate examination sessions shall not be allowed to register for any course, except that, in accordance with the resolution of the Governing Body of 1 April 2004, at the request of the student the Vice-Chancellor may authorize a final attempt at that subject. This may only be conceded in the academic year following the sixth unsuccessful attempt.
- By a resolution of the Standing Committee of 18 October 1990, from that date onwards until the Social Board lays down the norms for good standing of students in departments of the University of Leon, failure by a student to attend the final examination in a subject shall automatically be deemed not to constitute a failed attempt at the subject in question.
- By a resolution of the Governing Body of 1 April 2004, the Vice-Chancellor may authorize further registration by students who have no more than three subjects still to complete in an academic year, in the case of programmes of studies which it has been decided to discontinue, even after the expiry of the normal time period envisaged by current regulations for discontinuation of such programmes.

1.9 *Further Information Required for Issue of the European Supplement.*

TYPE OF INSTITUTION AWARDING THE QUALIFICATION

- State University

NATURE OF THE UNIVERSITY CENTRE INVOLVED

- School within the requesting University

Professions for which Successful Completion of the Course is an Appropriate Entry Qualification

- Technical Engineer in Computing. (As indicated in the *Boletín Oficial de Estado* [Spanish Official Gazette] of Tuesday 4 August 2009).

Languages Used

- Spanish.
- English

Orientation of the Qualification

- This is a degree with a professional-vocational orientation.

Branch of Knowledge

- Engineering and Architecture

Fields of Study

- Software Engineering
- Databases
- Programming
- Artificial Intelligence
- Knowledge Engineering
- Formal Languages
- Computer Architectures
- Web Technologies
- Computer Security

2 Teaching Plan

2.1 Structure of the Course

In accordance with *Order CIN/308/2009, of 9 February 2009 (published in the Spanish Official Gazette on 18 February 2009), which establishes the requirements for recognition of official university degrees that serve as an entry qualification for the profession of Technical Aeronautical Engineer,* the course of studies is divided into the following Modules:

Module		ECTS
Basic Core [Core]		60
Common Core for Computing		60
Specific Technology (Information Technology)		48
Courses Specific to the University of Leon [ULE]	Compulsory Subjects [Comp]	24
	Optional Subjects [Opt]	36
Final Year Project		12
TOTAL		240

2.2 Subject Areas Forming the Syllabus

The following tables specify the subject areas forming each of the Modules listed above. These tables also show the specific skills associated with each subject area.

Module: Basic Core			
Subject Area	ECTS	Skills	Type
Mathematics	24	•Ability to resolve the mathematical problems arising in engineering. Ability to apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics and optimization. •Ability to understand and master the basic concepts of discrete de mathematics, logic, algorithms, and computational complexity, and their application to the solving of problems typical of engineering.	Core
Physics	12	•Understanding and mastery of the basic concepts of fields and waves, electricity and magnetism, theory of electric circuits, and their application to solving problems typical of engineering. •Understanding and mastery of the basic concepts of electronic circuits, the physical principles of semiconductors and logical families, electronic and photonic devices and their application to solving problems typical of engineering.	Core
Computing	18	• Basic knowledge of the use and programming of computers, databases and computer programs with applications to engineering. • Awareness of the structure, organization, functioning and interconnection of computer systems, the basics of programming them, and their application to solving problems typical of engineering. • Basic knowledge of operating systems.	Core
Business Studies	6	• Adequate knowledge of the concept of a business, institutional and legal frameworks for businesses. Business organization and management.	Core

Module: Common Core for Computing			
Subject Area	ECTS	Subjects	Type
Computing	6	•Knowledge of the characteristics, functions and structure of operating systems and of how to design and implement applications based on what they offer.	Comp
Programming	6	•Capacity to analyse, design, construct and maintain applications in a robust, secure and efficient way, selecting the most suitable paradigm and programming languages.	Comp
Data Structures	6	•Knowledge, design and efficient use of the types and structures of date most suited to the resolution of a problem.	Comp
Databases	6	•Knowledge and application of the characteristics, functions and structure of databases, permitting appropriate use of them, and design, analysis and implementation of applications based on them.	Comp
Software Engineering	6	•Knowledge and application of the principles, methods and life cycles of software engineering. •Ability to understand the importance of negotiation, effective work practices, leadership and communication skills in all software development contexts. •Knowledge of standards and regulations governing computing at Spanish, European and international levels. •Capacity to draw up a document specifying the technical details for a computer installation compliant with current standards and norms. •Capacity to design, develop, select and evaluate computer applications and systems, ensuring their reliability, security and quality, in accordance with ethical principles and current legislation and standards. •Capacity to design and evaluate human-computer interfaces guaranteeing accessibility and usability of computer systems, services and applications. •Knowledge, administration and maintenance of computer systems, services and applications. •Knowledge and application of the tools necessary for storing, processing and access to information systems, including those based on the web.	Comp
Algorithms	6	•Knowledge and application of the basic algorithmic procedures in information technology to design solutions to problems, analysing the suitability and complexity of the algorithms proposed.	Comp
Computers	6	•Capacity to gain awareness of, understand and evaluate the structure and architecture of computers, and of the basic components going to make them up.	Comp
Intelligent Systems	6	•Knowledge and application of the fundamental principles and basic techniques for intelligent systems and their practical application.	Comp
Communications Networks	6	•Knowledge and application of the characteristics, functions y structure of distributed systems, computer networks and the Internet and how to design and implement applications based on them. •Knowledge and application of the fundamental principles and basic techniques of parallel, concurrent, distributed and real-time programming.	Comp
Projects	6	•Capacity to plan, devise, develop and direct computer projects, services and systems in all contexts, leading their start-up and continuing improvement and evaluating their economic and social impacts.	Comp

Module: Specific Technology (Information Technology)			
Subject Area	ECTS	Subjects	Type

Computing	12	•Capacity to select, develop, integrate and manage information systems satisfying the needs of an organization, using the criteria for cost and quality identified. •Capacity to select, design, develop, integrate, evaluate, construct, manage, make use of and maintain hardware and software technology, within appropriate cost and quality parameters.	Comp
Software Engineering	6	•Capacity to understand the environment of an organization and its needs in the field of information and communications technologies.	Comp
Security	6	•Capacity to understand, apply and manage guarantees and security of computer systems.	Comp
Communications Networks	6	•Capacity to select, design, develop, integrate, evaluate, construct, manage, make use of and maintain network technologies, within appropriate de cost and quality parameters. •Capacity to select, design, develop, integrate and manage communications networks and infrastructures in an organization.	Comp
Internet Services	12	•Capacity to devise systems, applications and services based on network technologies, including the Internet, webs, electronic trading, multimedia, interactive services and mobile computing.	Comp
Accessibility	6	•Capacity to use methods centred on the user and the organization to develop, evaluate and managed applications and systems based on information technologies ensuring accessibility, and the ergonomic and usable nature of systems.	Comp

Module: Specific to ULE			
Subject Area	ECTS	Subjects	Type
Algorithms	6	•Capacity to evaluate the computational complexity of a problem, particularly ability to discriminate between the various classes of complexity and to recognize problems as computationally equivalent and be aware of algorithm strategies that may lead to their solution, recommending, developing and implementing the strategy giving the best performance.	Comp
Intelligent systems	6	•Capacity to gather, obtain, formalize and represent human knowledge in a computable form for the solving of problems by means of a computer system in any application environment, particularly those relating to aspects of computation, perception action in intelligent environments or contexts.	Comp
	6	•Design of information systems for business management decision-taking and intelligent business.	Opt
Language Processors	6	•Capacity to grasp the theoretical fundamentals of programming languages and the techniques for lexical, syntactic and semantic processing associated with them and awareness of how to apply them to the creation, design and processing of languages.	Comp
English	6	•Ability to understand various types of texts in the technical English of computing, whether spoken or written, recognizing specific terminology, grammatical structures and text conventions characteristic of the information technology sector. •Capacity to acquire the skills necessary to draw up, in English, reports, technical specification documents, correspondence with manufacturers, suppliers and customers, project presentations for meetings, consultations in international technical forums and other documents relating to the completion of the tasks typically facing graduates in computing.	Comp
Mathematics	6	•Knowledge of principles, mathematical foundations and evolutionary strategies and their application to the solving of problems of optimization and classification. •Capacity to analyse problems in engineering and (bio)technology by means of tools for neural and genetic computation.	Opt
Computers	12	•Capacity to develop specific processors and nested systems, and to produce and optimize software for such systems. •Adequate knowledge of grid computing and supercomputing.	Opt

Module: Specific to ULE			
Subject Area	ECTS	Subjects	Type
Security	6	•Capacity to manage security in communications networks.	Opt
Communications Networks	6	•Knowledge and application of the peculiarities and characteristics of wireless data transmission networks, in respect of their design, configuration, security and use, together with the various different technologies with which such networks are implemented.	Opt
Applications	30	•Capacity to design systems for image acquisition and processing and to use them for content analysis. •Capacity to understand the techniques, methods and tools relating to the modelling of knowledge and knowledge of how to design and build applications using these techniques for representing, integrating, searching for and recovering complex information, in particular in the context of the Internet and web-based services. •Capacity to understand and knowledge of how to apply techniques for three-dimensional design, modelling and animation of objects, as well as an ability to carry out all the stages of an audiovisual production project in real contexts. •Capacity to use and apply computer tools for automation, control and monitoring of systems. •Capacity to understand and apply the principles and techniques of quality management and technological innovation in organizations.	Opt
Work Placement	6	•Capacity to develop working practices appropriate for the professional environment of computing.	Opt

Module: Final Year Project			
Subject Area	ECTS	Skills	Type
Final Year Project	12	•An original piece of work to be completed on an individual basis and presented to a university board of examiners, where the student will speak to the paper presented. It will consist of a project in the area of the technologies specific to industrial engineering of a professional nature, which will bring together and integrate the skills acquired during the programme of studies.	Comp

This programme of studies provides 72 ECTS of Optional Subject courses. Students are required to study only 36 ECTS of Optional Subject courses. These may be made up by any of the following choices:

a. Taking Optional Subjects offered in this programme of studies.

b. Taking Optional Subjects from among those provided in courses leading to the following qualifications from this School, with the proviso that those chosen must not include subjects with overlapping or coinciding content:

- Graduate in Mechanical Engineering
- Graduate in Engineering in Industrial Electronics and Automation
- Graduate in Aerospace Engineering

c. In accordance with Article 46.2.i of the Spanish Basic Law on Universities 6/2001, of 21 December 2001, students may be awarded academic credits up to a maximum of 6

within the total required for their programme of studies for participation in university activities of a cultural, sporting, student representation, welfare or co-operative nature.

d. Students may be awarded credits up to a maximum of 6 for work placements, on the basis of 25 hours of placement per credit.

2.3 Division of Subject Areas into Individual Subjects

The Subject Areas described above are sub-divided into individual subjects as specified in the following tables. All individual subjects have a weighting of 6 ECTS, except the Final Year Project, which has a weighting of 12 ECTS.

Module: Basic Core				
Subject Area	ECTS	Subjects	ECTS	Type
Mathematics	24	Differential and Integral Calculus	6	Core
		Algebra	6	
		Discrete Mathematics	6	
		Numerical and Statistical Methods	6	
Physics	12	Physics	6	Core
		Electronics	6	
Computing	18	Programming I	6	Core
		Structure of Computers	6	
		Operating Systems	6	
Business Studies	6	Fundamentals of Business Administration	6	Core

Module: Common Core for Computing				
Subject Area	ECTS	Subjects	ECTS	Type
Computing	6	Further Operating systems	6	Comp
Programming	6	Programming II	6	Comp
Data Structures	6	Data Structures	6	Comp
Databases	6	Databases	6	Comp
Software Engineering	6	Software Engineering I	6	Comp
Algorithms	6	Algorithms and Flowcharts	6	Comp
Computers	6	Computer Architectures	6	Comp
Intelligent Systems	6	Introduction to Intelligent Systems	6	Comp
Communications Networks	6	Distributed Systems	6	Comp
Projects	6	Project Management	6	Comp

Module: Specific Technology (Information Technology)				
Subject Area	ECTS	Subjects	ECTS	Type

Computing	12	Information Systems I	6	Comp
		Information Systems II	6	
Software Engineering	6	Software Engineering II	6	Comp
Security	6	Computer Security	6	Comp
Communications Networks	6	Network Architecture, Design and Management	6	Comp
Internet Services	12	Web Applications	6	Comp
		Internet Services	6	
Accessibility	6	Accessibility	6	Comp

Module: Specific to ULE				
Subject Area	ECTS	Subjects	ECTS	Type
Algorithms	6	Computational Complexity	6	Comp
Intelligent systems	12	Knowledge Engineering	6	Comp
		Information systems for Management and Business Intelligence	6	Opt
Language Processors	6	Language Processors	6	Comp
English	6	English	6	Comp
Mathematics	6	Neural and Evolutionary Computation	6	Opt
Computers	12	Specific and Nested Architectures	6	Opt
		Grid Computing and Supercomputing	6	
Security	6	Security in Communications Networks	6	Opt
Communications Networks	6	Mobile and Wireless Networks	6	Opt
Applications	30	Artificial Sight	6	Opt
		Semantic Modelling Techniques for the Web	6	
		Computer Animation	6	
		Applied Computing for Automation and Control	6	
		Technological Innovation	6	
Work Placement	6	Work Placement	6	Opt

Module: Final Year Project				
Subject Area	ECTS	Subjects	ECTS	Type
Final Year Project	12	Final Year Project	12	Comp

2.4 Scheduling of Subjects

The subjects comprised in the programme of studies are distributed over the years and semesters of the course as shown in the following tables:

First Year			
First Semester		**Second Semester**	
Subject	**ECTS**	**Subject**	**ECTS**
Differential and Integral Calculus	6	Algebra	6
Discrete Mathematics	6	Numerical and Statistical Methods	6
Physics	6	Structure of Computers	6
Electronics	6	Programming I	6
English	6	Fundamentals of Business Administration	6
TOTAL	30	**TOTAL**	30

Second Year			
Third Semester		**Fourth Semester**	
Subject	**ECTS**	**Subject**	**ECTS**
Programming II	6	Introduction to Intelligent Systems	6
Databases	6	Further Operating Systems	6
Operating Systems	6	Data Structures	6
Algorithms and Flowcharts	6	Network Architecture, Design and Management	6
Information Systems I	6	Computer Architectures	6
TOTAL	30	**TOTAL**	30

Third Year			
Fifth Semester		**Sixth Semester**	
Subject	**ECTS**	**Subject**	**ECTS**
Knowledge Engineering	6	Computer Security	6
Software Engineering I	6	Information Systems II	6

Project Management	6	Web Applications	6
Distributed Systems	6	Option 1	6
Internet Services	6	Option 2	6
TOTAL	30	**TOTAL**	30

Fourth Year			
Seventh Semester		**Eighth Semester**	
Subject	**ECTS**	**Subject**	**ECTS**
Final Year Project	6	Final Year Project	6
Computational Complexity	6	Language Processors	6
Accessibility	6	Software Engineering II	6
Option 3	6	Option 5	6
Option 4	6	Option 6	6
TOTAL	30	**TOTAL**	30

In each Option slot indicated in the schedule for courses given above, the School will offer a choice of two of the Optional Subjects listed in Section 5.3

2.5 Planning and Management of Mobility

The University of Leon has an *Oficina de Relaciones Internacionales y Movilidad* [Office for International Relations and Mobility] which is responsible for:

- The process of signing bilateral agreements, and publicizing them in various media.
- The selection of candidates on the basis of their academic and linguistic competence.
- Advising candidates during the admissions procedure in the receiving institution and with respect to internal academic requirements in ULE.
- Follow-up during the stay.
- Procedures for academic recognition.
- Financial management.

- Analysis of availability and demand for each institution and evaluation of student satisfaction through surveys and/or personal interviews.

REGULATIONS:

- *The regulations for recognition of studies for students of the University of Leon participating in exchange programmes* were approved by the Governing Body on 20 December 2004. These regulations apply to the procedure and determine the responsibilities of those concerned within Schools and Faculties: the Faculty Co-ordinator for Mobility Programmes and the Exchange Student Tutors. These are nominated by the Deputy Vice-Chancellor for International Relations at the proposal of the relevant Dean or Director, their time in such office being coterminous with that of the person proposing them.
- *The procedure for the recording of marks* was established by a Resolution of the Governing Body on 20 December 2004, regulating the academic management of marks for those participating in mobility programmes. This procedure consists of the drawing up of an independent transcript for every student involved in a mobility programme inside or outside Spain. In this transcript the marks are recorded by the Mobility Co-ordinator separately from those of the remaining students, in order not to delay the preparation of general marks lists.
- *Scholarship guide* for mobility programmes.
- *Annual announcement* for each mobility programme and details of the regulations governing it

AGREEMENTS WITH OTHER UNIVERSITIES FOR THE EXCHANGE OF STUDENTS WITH ACADEMIC RECOGNITION

1. Lifelong Learning Programme – Socrates/Erasmus

University	Country
Fachhochschule Frankfurt am Main	Germany
Fachhochschule Schmalkalden	Germany
Hochschule Ulm Technik, Informatik und Medien	Germany
Universität Kaiserslautern	Germany
Hogeschool Antwerpen	Belgium
University of Antwerp	Belgium
Aarhus Universitet - Datalogisk Institut	Denmark
Ingeniørhøjskolen i København	Denmark
University of Southern Denmark	Denmark
University of Maribor	Slovenia
Université d'Évry Val d'Essonne	France
Université Henri Poincaré	France
Université Paris 13	France

Rijksuniversiteit Groningen	Netherlands
Technische Universiteit Eindhoven	Netherlands
Institute of Technology Tralee	Ireland
Terza Università degli Studi di Roma	Italy
Università degli Studi di Lecce	Italy
Università degli Studi di Bolonia	Italy
Università degli Studi di Cagliari	Italy
Università degli Studi di Catania	Italy
Università degli Studi di Perugia	Italy
Kaunas University of Technology	Lithuania
Vilnius Gediminas Technical University	Lithuania
Akademia Polonijna w Czestochowie	Poland
Politechnika Krakowska	Poland
Politechnika Warszawska	Poland
Politechnika Wroclawska	Poland
Instituto Politécnico de Coimbra	Portugal
Instituto Politécnico de Bragança	Portugal
Instituto Politécnico de Guarda	Portugal
Instituto Superior Técnico de Lisboa	Portugal
Instituto Politécnico de Leiria	Portugal
Universidade de Coimbra	Portugal
Universidade de Evora	Portugal
Universidade de Tras Os Montes e Alto Douro	Portugal
Universidade do Algarve	Portugal
Universidade do Minho	Portugal
Universidade Portugalense Infante D. Henrique	Portugal
Univerzita Pardubice	Czech Republic
Högskolan i Halmstad	Sweden
Kristianstad University	Sweden

2. Amicus Programme

University	Country
Universidad Nacional de La Patagonia San Juan Bosco	Argentina
Victoria University	Australia
University of New South Wales	Australia
University of Wollongong	Australia
Universidade de Caxias Do Sul	Brazil
Universidade de Cruz Alta	Brazil
Universidade do Estado de Santa Catarina	Brazil
Universidade Federal de Santa Catarina	Brazil
Centro Universitario Lasalle	Brazil
Universidade do Passo Fundo	Brazil

Universidade Federal de Pelotas	Brazil
Pontificia Universidade Catolica Rio Grande do Sul	Brazil
Universidade Federal do Rio de Janeiro	Brazil
Universidad de Sorocaba	Brazil
Universidade Luterana de Brasil	Brazil
Universidade do Sul de Santa Catarina	Brazil
Universidade Federal de Viçosa	Brazil
Université Laval	Canada
Université de Montreal	Canada
Universidad Mayor	Chile
Universidad Finis Terrae	Chile
Universidad Autónoma del Sur	Chile
Universidad Adolfo Ibáñez	Chile
Universidad de Viña del Mar	Chile
Universidad de Ciencias Aplicadas y Ambientales	Colombia
Universidad de Medellín	Colombia
Universidad Tecnológica de Pereira	Colombia
Centro Universitario José Martí Pérez de Sancti Spiritus	Cuba
University of Rikkyo	Japan
Universidad Autónoma de Coahuila	Mexico
Universidad de Colima	Mexico
Universidad Autónoma de Guadalajara	Mexico
Universidad de La Salle Bajío	Mexico
Universidad Iberoamericana de León	Mexico
Instituto Tecnológico de Monterrey (Campus De León)	Mexico
Universidad Iberoamericana de León	Mexico
Universidad de Las Américas - Puebla	Mexico
Benemérita Universidad Autónoma de Puebla	Mexico
Universidad Autónoma del Estado de México	Mexico
Universidad Veracruzana	Mexico
Universidad César Vallejo Filial Piura	Peru
Universidad Columbia del Paraguay	Paraguay
International University of Moscow	Russia
Voronezh State University	Russia
Gardner-Webb University	U.S.A
Central Connecticut State University	U.S.A
Michigan Technological University	U.S.A
Northern Kentucky University	U.S.A
Pitzer College	U.S.A
University of New York at Stony Brook	U.S.A
University of Central Arkansas	U.S.A
University of Wisconsin Green Bay	U.S.A
University of Vermont	U.S.A

The universities and other institutions with Lifelong Learning – Socrates/Erasmus agreements are suited to the objectives for this qualification, as they offer similar programmes of studies to that presented in this syllabus. Exchange students can acquire in these institutions the skills necessary to allow recognition of the various subjects studied.

In contrast, agreements with universities in countries not belonging to the European Union (Amicus programme) permit the exchange of students with such universities, without specification of the course involved. Nonetheless, in all these institutions there are schools of engineering in which many of the skills comprised in this syllabus may be acquired. It is the task of the mobility co-ordinator to advise students as to which universities best match their learning needs.

2.6 Detailed Description of the Subjects in the Syllabus

All the subjects in the syllabus comprise 6 ECTS and their characteristics are described in a standard table, whose sections are explained below:

<table>
<tr><td colspan="8">SUBJECT DESCRIPTION TABLE</td></tr>
<tr><td colspan="2">Subject Title</td><td colspan="6"></td></tr>
<tr><td colspan="2">Subject Area</td><td colspan="6"></td></tr>
<tr><td colspan="2">Type</td><td colspan="6">Basic Core; Compulsory; Optional</td></tr>
<tr><td colspan="2">Number of ECTS Credits</td><td colspan="6">6</td></tr>
<tr><td colspan="2">Scheduling</td><td colspan="6">First Semester; Second Semester; .....</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="6">When subjects are specified in this section, it implies the following:
1. Students are recommended to have acquired prior knowledge of these subjects.
2. Students must currently be, or previously have been, enrolled for these subjects</td></tr>
<tr><td colspan="8">METHOD OF ASSESSMENT</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td colspan="8">TEACHING AND LEARNING ACTIVITIES</td></tr>
<tr><td rowspan="2">Type of Activity</td><td colspan="4">Student Work Hours
(25 for each ECTS credit)</td><td rowspan="2">ECTS</td><td rowspan="2">%</td><td rowspan="2">Related Skills</td></tr>
<tr><td colspan="3">With Instructor</td><td>Without Instructor</td></tr>
<tr><td></td><td>C</td><td>S</td><td>T</td><td></td><td></td><td></td><td></td></tr>
<tr><td>1. Theoretical Studies</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Practicals</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3. Assessments</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>TOTAL</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">C = Class (whole-group session) S = Seminar (part-group session) T = Tutorial (individual session)</td></tr>
<tr><td colspan="8">Description of the teaching and learning activities</td></tr>
</table>

CONTENTS
DESCRIPTION OF SKILLS

SUBJECT DESCRIPTION TABLE	
Subject Title	Differential and Integral Calculus
Subject Area	Mathematics
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:
- In-class written tests.
- Work to be submitted, such as essays and similar.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	9	8.5	0.25	30	1.91	31.83	All
2. Practicals	9	27		60	3.85	64	All
3. Assessments	6		0.25		0.24	4.17	All
TOTAL	24	35.5	0.5	90	6	100	

All student work with teachers will require attendance at timetabled sessions.

Whole-class sessions (C) comprise activities carried out in large groups of up to 80 students.

Seminar work (S) comprises activities carried out in "medium" groups of up to 25 students.

Tutorials (T) comprise activities carried out individually or in small group work in some cases.

CONTENTS

I. Number sequences and series
II. Limits and continuity of functions with one and several variables
III. Differential calculus of functions with one and several variables
IV. Integral calculus of functions with one and several variables

DESCRIPTION OF SKILLS
Transferable: **a.** Ability to communicate, in spoken and/or written form, information, ideas, problems and solutions by means of mathematical language. **b.** Ability for critical thinking and self-critique. Specific to the subject: **c.** Ability to resolve mathematical problems arising in engineering. **d.** Ability to apply a knowledge of differential and integral calculus.

SUBJECT DESCRIPTION TABLE	
Subject Title	Algebra
Subject Area	Mathematics
Type	Core
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	18	6.5	0.25	35	2.39	39.8	all
II.	Practicals	9	20	0.25	35	2.57	42.9	all
III.	Assessments	3	3		20	1.04	17.3	all
	TOTAL	30	29.5	0.5	90	6	100	

In order to undertake the teaching and learning activities involved in the course, it is recommended that students should have acquired the skills of the subject Discrete Mathematics.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder may be undertaken by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom (Type C) sessions, the instructor will introduce the basic materials relating to the specific skills to be acquired by means of theoretical explanations and practical examples.

In smaller-group (Type S) sessions, the instructor will cover materials from the subject in more detail and will organize practical teaching and learning activities to allow the solving of problems typical of computer engineering.

Tutorial sessions (T) comprise activities carried out individually or in some instances in small groups.

CONTENTS
I. Integer and modular arithmetic. II. Polynomials. III. Gaussian elimination. IV. Vector spaces. V. Linear Applications. VI. Diagonalization.

DESCRIPTION OF SKILLS
Specific to the subject: a. Understanding and mastery of the concepts of Euclidean division, divisibility and congruence in respect of integer numbers and polynomials. Awareness of the basic algorithmic techniques relating to these concepts and ability to apply them to the solving of problems typical of engineering. b. Understanding and mastery of the concepts of vector spaces and linear applications. Awareness of the basic algorithmic techniques in linear algebra, and ability to apply them to the solving of problems typical of engineering. **Transferable:** a. Capacity to analyse and synthesize using mathematical language. b. Capacity to apply the mathematical concepts and procedures learnt to the development of accurate reasoning and argumentation. c. Capacity to cope with situations involving the use of new mathematical knowledge and techniques, hence enhancing ability to learn independently. d. Ability to work as part of a group, selecting the various tasks comprising the work to be done and sharing them among the different members of the group. c. Ability to communicate, in spoken and/or written form, information, ideas, problems and solutions by means of mathematical language..

SUBJECT DESCRIPTION TABLE	
Subject Title	Discrete Mathematics
Subject Area	Mathematics
Type	Core
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	

METHOD OF ASSESSMENT
Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities: - In-class written tests. - Work to be submitted. - Oral presentations. - Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	18	6.5	0.25	35	2.39	39.8	all
II.	Practicals	9	20		35	2.57	42.7	all

III. Assessments	3	3	0,25	20	1.04	17.3	all
TOTAL	30	29.5	0.5	90	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder may be undertaken by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom (Type C) sessions, the instructor will introduce the basic materials relating to the specific skills to be acquired by means of theoretical explanations and practical examples.

In smaller-group (Type S) sessions, the instructor will cover materials from the subject in more detail and will organize practical teaching and learning activities to allow the solving of problems typical of computer engineering.

Tutorial sessions (T) comprise activities carried out individually or in some instances in small groups.

CONTENTS

I. Sets and applications. Counting techniques.
II. Relationships.
III. Introduction to formal logic.
IV. Boolean algebras.

DESCRIPTION OF SKILLS

Specific to the subject:

a. Understanding and mastery of the basic concepts of discrete mathematics and their application to resolving problems specific to engineering.

Transferable:

b. Capacity to analyse and synthesize using mathematical language.
c. Capacity to apply the mathematical concepts and procedures learnt to the development of accurate reasoning and argumentation.
d. Capacity to cope with situations involving the use of new mathematical knowledge and techniques, hence enhancing ability to learn independently.
e. Ability to work as part of a group, selecting the various tasks comprising the work to be done and sharing them among the different members of the group.
f. Ability to communicate, in spoken and/or written form, information, ideas, problems and solutions by means of mathematical language.

SUBJECT DESCRIPTION TABLE

Subject Title	Numerical and Statistical Methods
Subject Area	Mathematics
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted.
- Oral presentations.

- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES							
Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	18	8.5	0.25	30	2.27	37.83	a, b, c
Practicals		27		51	3.13	52.17	a, b, c
Assessments	5	1	0.25	9	0.60	10	All
TOTAL	23	36.5	0.50	90	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder may be carried out by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

Whole-class sessions (C) comprise activities carried out in large groups of up to 80 students.

Seminar work (S) comprises activities carried out in "medium" groups of up to 25 students. To the extent that the resources available to the University permit, practical sessions will use software packages.

Tutorials (T) comprise activities carried out individually or in small group work in some cases.

CONTENTS

I. Numerical methods: solving equations, data adjustment, numerical integration …

II. Statistical methods: descriptive statistics, probability, introduction to statistical inference ….

DESCRIPTION OF SKILLS

a. Ability to solve the mathematical problems arising in engineering.
b. Ability to apply a knowledge of numerical methods, numerical algorithms, statistics and optimization.
c. Ability to analyse and synthesise.
d. Ability to communicate, in spoken and/or written form, information, ideas, problems and solutions by means of mathematical language.

SUBJECT DESCRIPTION TABLE	
Subject Title	Physics
Subject Area	Physics
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	Not applicable

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired whether individually or in groups, will be achieved by assigning appropriate weightings to the following activities:

- Examinations.
- Reports on laboratory work.
- Work periodically submitted for assessment, whether done individually or in groups.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	30	3	0.25	41.75	3	50.00	a, b, e
II. Practicals	11	10	0.5	48.5	2.8	46.70	b, c, d, e
III. Assessments	4	0.75	0.25	0	0.2	3.3	all
TOTAL	45	13.75	1	90.25	6	100	

All teaching and learning activities of students with instructors will require attendance at timetabled sessions.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject area, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Exercises will be set for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

In practical sessions in the laboratory, the instructor will assist the students to gain a knowledge of safety and behaviour standards, of the handling of the basic equipment of physics laboratories and in the use of instruments to determine the physical magnitudes of work. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions, and in them will apply the tools for solving problems that they have acquired.

Whole-group sessions (Type C) include both traditional classroom activities (theoretical explanations and solving problems) and co-operative efforts involving the whole group aimed at working on problems set in advance.

Seminar sessions (Type S) will concentrate on more detailed working through of various points not fully covered and of interest for the particular group of students.

CONTENTS

I. Electric fields and potentials
II. Electric fields in conductors and dielectrics
III. Electrokinetics
IV. Magnetic fields and their sources
V. Magnetic properties of materials
VI. Electromagnetic induction
VII. Transitory flows in electric circuits
VIII. Alternating current
IX. Electromagnetic fields

DESCRIPTION OF SKILLS

Specific to the subject:

a. Understanding and mastery of the basic concepts of **fields and waves, electricity and magnetism, and the theory of electric circuits**, and their applications to solving problems typical of engineering.

Transferable:

b. Demonstration by the students that they **possess and understand information from a field of study** going beyond the basis gained in general secondary education and which is of a standard such that, while based on higher-level textbooks, also includes certain aspects that imply knowledge gained from the cutting edge of their field of study.

c. Ability of students to **apply their knowledge to their work** or vocation in a professional manner, to demonstrate their skills by **formulating and arguing in favour of given viewpoints and solving problems** within their field of study.

d. Capacity of students to **gather and interpret relevant data** (normally from within their field of study) so as to be able to **form and express opinions** involving thought about appropriate topics of a social, scientific or ethical nature.

e. Development by students of the learning abilities needed to **undertake further study** with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Electronics
Subject Area	Physics
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class tests.
- Work to be submitted.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	25	5	0.5	40	2.82	47.00	a,b,c,d,f
II. Practicals	5	18	0.5	30	2.14	35.67	All
III. Assessments	3	2	1	20	1.04	17.33	All
TOTAL	33	25	2	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, following guidelines supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder may be carried out by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and modelling them in the area of engineering, at all times encouraging critical thinking and the exchange of information between students.

CONTENTS

I. Fundamentals of electronics
II. Semiconductors, electronic devices and technology.
III. Representation of information in digital systems
IV. Combinatorial and sequential digital systems

DESCRIPTION OF SKILLS

a. Understanding and mastery of the basic concepts of electronic circuits.
b. Understanding and mastery of the physical principles of semiconductors and logic families, electronic and photonic devices, and their applications to solving problems typical of engineering.
c. Capacity to organize and plan
d. Ability to learn independently
e. Capacity for team work
f. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE

Subject Title	Programming I
Subject Area	Computing
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	None

METHOD OF ASSESSMENT

The assessment of student work, whether done during attendance at timetabled sessions or not, and of the skills acquired individually or in a group, will be achieved by assigning appropriate weightings to in-class tests, group work and work submitted for marking.

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	28	6	0.5	28	2.5	41.67	a, b, c
II.	Practicals		22	1	39.5	2.5	41.67	a, b, c, d, e, f
III.	Assessments	2	2	0.5	20.5	1	16.67	d, e
TOTAL		30	30	2	88	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder may be carried out by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

This subject takes an essentially practical approach, being based on putting into practice the theoretical

knowledge acquired in classes. Every concept covered theoretically will be complemented by exercises and practicals such as to ensure that students demonstrate adequate assimilation of this theoretical content.

CONTENTS

I. Introduction – Programming and programming paradigms
II. Analysis and design – From mastering the problem to mastering the solution
III. Basic techniques – Good practice in programming
IV. Implementation – Concept of variables, their use and definition of types, flow of execution, persistence
V. Debugging and trialling – Incremental trials and register files
VI. Development environment – Working tools

DESCRIPTION OF SKILLS

a. Basic knowledge of the use of databases and computer programs with applications to engineering.
b. Theoretical knowledge of programming.
c. Practical knowledge of programming.
d. Ability to apply a knowledge of programming both to the analysis, design and implementation of applications, and to the interpretation of code written by others.
e. Capacity to generate and distinguish high-quality code.
f. Ability to work in a team.

SUBJECT DESCRIPTION TABLE

Subject Title	Structure of Computers
Subject Area	Computing
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	Electronics and Programming

METHOD OF ASSESSMENT

Assessment will be by tests spread out over the whole semester, coinciding with the ends of homogeneous blocks of instruction. Exercises and skills worked on individually and in group-work, whether or not carried out under the supervision of an instructor, will also be assessed.
At the end of the semester there will be an examination relating to points covered during the whole course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	35		1.25	35	2.85	47.5	All
II.	Practicals		25	1.25	24	2.01	33.5	All
III.	Assessments	2.5	2.5	0.5	23	1.14	19	All
	TOTAL	37.5	27.5	3	82	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of the use of tools for long-distance communication.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In practical sessions in the classroom and the laboratory, the instructor will guide the students in the application of theoretical concepts and results to the solving problems and the writing of programs, at all times encouraging critical thinking and the exchange of information between working groups. Exercises and programming work will be set for the students to complete, thus acquiring skill in the use of the tools necessary for the resolution of problems and the preparation of programs.

CONTENTS

I. Introduction to computers.
II. Assembler language.
III. Computer arithmetic.
IV. Data routing and control unit.
V. Memory hierarchy.
VI. Input-output system.
VII. Practicals: programming in assembly code.

DESCRIPTION OF SKILLS

a. Knowledge of the structure, organization, operation and interconnection of computer systems.
b. Knowledge of the fundamentals of programming of computer systems.
c. Knowledge of the application of computer systems to solving problems typical of engineering.
d. Capacity to analyse and solve problems.
e. Capacity to interpret results.
f. Ability to work as part of a group.
g. Effective development of spoken and written communication.
h. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.
i. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.
j. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.

SUBJECT DESCRIPTION TABLE	
Subject Title	Operating Systems
Subject Area	Computing
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	Programming

METHOD OF ASSESSMENT

Assessment of student work, whether done during attendance at timetabled sessions or otherwise, and the skills acquired, either individually or in group work, will be achieved by assigning appropriate

weightings to the following activities:
- In-class tests.
- Work to be submitted (software, written work and exercises).
- Exposés, presentations and participation in classes.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	25		0.5	25	2	33.7	a, b, d
II. Practicals		30	0.5	58	3.6	59	a, b, c
III. Assessments	5		0.25	5.75	0.4	7.3	a, d
TOTAL	30	30	1.25	88.75	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder may be carried out by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In sessions of S-type work the instructor will guide the students in the use of operating systems and tools for administering, managing and monitoring operating systems. The instructor will also orient students in the solving of problems using threads and processes.

CONTENTS

I. History, functions and component parts of operating systems
II. Structure of operating systems, system calls and start-up procedures
III. System tools
IV. Processes and planning for the use of the Central Processing Unit
V. Threads: types, management and programming with threads

DESCRIPTION OF SKILLS

a. Basic knowledge of operating systems.
b. Capacity for independent learning.
c. Ability to work as part of a group.
d. Learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Fundamentals of Business Administration
Subject Area	Business Studies
Module	Basic Core
Type	Core
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted at intervals, whether done individually or as a group task.
- Complementary activities.

TEACHING AND LEARNING ACTIVITIES								
Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	20	2	0.2	22	1.77	29.46	a, b, c
II.	Practicals	10	20	0.3	40	2.81	46.86	a, b, c, d, e
III.	Assessments	4	2.5	1	28	1.42	23.67	All
	TOTAL	34	24.5	1.5	90	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of the use of new information and communications technologies (ICTs). As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In practical sessions in the classroom (whether whole-group or seminar-group), the instructor will guide the students in the application of theoretical concepts and results to the solving problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, thus acquiring skill in the use of the tools necessary for the resolution of problems.

CONTENTS

I. Businesses as systems
II. Businesses and entrepreneurs. Institutional and legal framework
III. Business management and the decision-making process. Organization and management
IV. Development and growth of businesses
V. Introduction to Human Resource Management in businesses
VI. Introduction to operational management
VII. Introduction to commercial management
VIII. Introduction to financial management

DESCRIPTION OF SKILLS

a. Adequate knowledge of the concept of an enterprise, its institutional and legal framework. Business organization and management.
b. Applied knowledge of business organization
c. Ability to analyse and solve problems
d. Ability to learn independently
e. Ability to work in a group
f. Critical reasoning

SUBJECT DESCRIPTION TABLE	
Subject Title	Further Operating Systems
Subject Area	Computing
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	Programming

METHOD OF ASSESSMENT

Assessment of student work, whether during attendance at timetabled sessions or otherwise, and the skills acquired, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted (software, written work and exercises).
- Exposés, presentations and participation in classes.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	25		0.5	25	2	33.7	a, b, d
II. Practicals		30	0.5	58	3.6	59	a, b, c
III. Assessments	5		0.25	5.75	0.4	7.3	a, d
TOTAL	30	30	1.25	88	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In type S working sessions the instructor will guide students in the implementation of modules putting into practice the functions and algorithms described in type C sessions.

CONTENTS

I. Memory management
II. Virtual memory
III. File systems
IV. Management of mass storage
V. Input-output systems
VI. Protection and security

DESCRIPTION OF SKILLS

a. Knowledge of the functional characteristics and structure of operating systems and the designing and implementation of applications based on their capacities.

b. Capacity to learn independently.

c. Ability to work as part of a group.

d. Learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Programming II
Subject Area	Programming
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	Programming I

METHOD OF ASSESSMENT
Assessment of student work, whether during attendance at timetabled sessions or otherwise, and the skills acquired, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities: in-class written tests, presentations and group work, work to be submitted for marking.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	4	0.3	19.4	1.75	29.2	a, b, d
II. Practicals		30	1.5	56.1	3.5	58.3	a, b, c, e
III. Assessments	2	4	0.2	12.5	0.75	12.5	a, b, c, d
TOTAL	22	38	2	88	6	100	

About 90% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

The practical part of the course will develop incrementally over the course of the semester. Starting from initial code, its weak points will be detected and redesigned using templates in such a way as to ensure the robustness and quality of the code in terms of maintainability.

CONTENTS

I. Object orientation – Encapsulation, inheritance and polymorphism
II. Design templates – Building robust, secure, efficient and easily maintained software
III. Creation templates
IV. Structural templates
V. Behavioural templates
VI. Other programming paradigms and their associated languages

DESCRIPTION OF SKILLS

a. Capacity to analyse problems and select the most flexible design solution so as to ensure maintainability of the code.
b. Capacity to form reasoned critical judgements with respect to the quality of code.
c. Capacity to develop maintain applications in a robust, secure and efficient way, ensuring their maintainability.
d. Basic knowledge of the programming paradigms available and their associated languages.
e. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Data Structures
Subject Area	Data Structures
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	Programming I, Programming II

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired will be achieved by assigning weightings to:
- The results of an examination on the theoretical part of the subject.

- Observation of laboratory work.
- Evaluation of obligatory practicals and the way in which students argue in favour of their solutions.

TEACHING AND LEARNING ACTIVITIES							
Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
- Theoretical Studies	30		1	40	2.84	47.34	a, d
- Practicals		30	1		1.24	20.66	a, b, c, d, e
- Assessments	3	2	1	42	1.92	32.00	a, d, f
TOTAL	33	32	3	82	6	100	

The theoretical portion of the subject will involve attendance at timetabled classes combined with private study by pupils with the aim of consolidating points covered in the classes they attend. It is estimated that each hour of theory classes will require a further hour of private study without the instructor. There will also be ten hours of such study dedicated to general revision.

The practical part of the course will involve attendance at laboratory sessions with the instructor. In these students will implement on computers the concepts studied in theory sessions.

In addition, there will be various compulsory practicals which students will complete on their own, their work being supported by the individualized tutorial hours. Assessment hours without the instructor recorded in the table are those estimated to be necessary to complete these compulsory practical assignments.

CONTENTS

1. Fundamentals of data structures.
2. The concept of data in the abstract.
3. Lists, stacks and queues.
4. Trees.
5. Flowcharts.
6. Hashing.

DESCRIPTION OF SKILLS

a. Knowledge, ability to design and make efficient use of the data types and structures most suited to solving any given problem.
b. Capacity to solve practical programming problems.
c. Capacity to evaluate and use third-party libraries of data structures.
d. Capacity to learn independently.
e. Ability to work as part of a group.
f. Ability to formulate and argue in favour of given viewpoints and to solve problems within the field of study.

SUBJECT DESCRIPTION TABLE	
Subject Title	Databases
Subject Area	Databases
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	26		0.2	25.0	2.05	34.17	a, d, e, f, h
II.	Practicals		28	0.2	37.6	2.63	43.83	a, b, c, f, g, h
III.	Assessments	4	2	2.0	25.0	1.32	22.00	all
TOTAL		30	30	2.4	87.6	6	100	

About 90% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, methods and fundamental problems of the subject, by means of theoretical explanations and illustrative examples.

In practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Students will have available to them guidelines that will permit them to go step by step through the various concepts that will be covered in each practical session. They will make use of one or more database management tools to create and administer such databases to solve the various problems set in the outline for practicals. They will also employ a relational database interrogation language so as to become familiar with it and skilled in its use.

Students will have to complete at least one mini-project on a topic set by the instructor and will have to speak to this project in a class session.

CONTENTS

I. Concepts.
II. Entity/relationship and extended entity/relationship models
III. Relational model
IV. Normalization.
V. SQL (Structured Query Language).
VI. Indexes.
VII. Transactions.
VIII. Concurrency.

DESCRIPTION OF SKILLS

a. Knowledge and application of the characteristics, functionalities and structure of databases, permitting their appropriate use, and design, analysis and implementation of applications based on them.
b. Knowledge of several systems for managing current databases
c. Knowledge of an enquiry language for databases
d. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.
e. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
f. Ability to learn independently.

g. Capacity for team work. h. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Software Engineering I
Subject Area	Software Engineering
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities:
- Work completed individually or as a group
- In-class written tests.
- Examinations.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	12	1	30	2.52	42.00	a, b, c, d, e ,f, g, h
II. Practicals		20	1	35	2.24	37.33	a, b, i, j ,k, l, m, n
III. Assessments	3	2	1	25	1.24	20.67	all
TOTAL	23	34	3	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

CONTENTS

I. Introduction to Software Engineering
II. Analysis of requirements
III. Structured and object-oriented design.
IV. Methodological aspects of the development of software systems.

DESCRIPTION OF SKILLS

a. Knowledge and application of the principles, methods and life cycles of software engineering.
b. Ability to understand the importance of negotiation, effective work practices,

leadership and communication skills in all software development contexts.

c. Knowledge of standards and regulations governing computing at Spanish, European and international levels.
d. Capacity to draw up a document specifying the technical details for a computer installation compliant with current standards and norms.
e. Ability to design, develop, select and evaluate computer applications and systems, ensuring their reliability, security and quality, in accordance with ethical principles and current legislation and standards.
f. Capacity to design and evaluate human-computer interfaces guaranteeing accessibility and usability of computer systems, services and applications.
g. Knowledge, administration and maintenance of computer systems, services and applications.
h. Knowledge and application of the tools necessary for storing, processing and access to information systems, including those based on the web.
i. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.
j. Capacity to understand the environment of an organization.
k. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.
l. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
m. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Algorithms and Flowcharts
Subject Area	Algorithms
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted, such as essays and similar.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	15	5	0.25	30	2.01	33.5	

II. Practicals	5.5	30	0.25	60	3.83	63.83	
III. Assessments	3.5	0.5			0.16	2.67	All
TOTAL	24	35.5	0.5	90	6	100	

All student work with teachers will require attendance at timetabled sessions.

Whole-group class sessions (C) comprise activities carried out in large groups of up to 60 students.

Seminar work (S) comprises activities carried out in "medium" groups of up to 25 students.

Tutorials (T) comprise activities carried out individually or in small group work in some cases.

CONTENTS

I. Analysis and design of algorithms: greedy algorithms, divide and rule, dynamic programming.
II. Flowcharts. Algorithms in flowchart form
III. Networks and network flows

DESCRIPTION OF SKILLS

Specific to the subject:

a. Knowledge and application of the basic algorithmic procedures of computer technology to design solutions for problems, analysing the suitability and complexity of the algorithms proposed.
b. Capacity to model certain problems by means of the use of flowchart theory, seeking algorithmic solutions to the problems considered.
c. Capacity model certain problems by means of the use of networks, seeking algorithmic solutions to the problems considered.

Transferable:

d. Capacity for critical thinking and self-critique.
e. Spoken and written communication in Spanish that is correct and precise.

SUBJECT DESCRIPTION TABLE

Subject Title	Computer Architectures
Subject Area	Computers
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment will be by tests spread out over the whole semester, coinciding with the ends of homogeneous blocks of presentation of materials. Exercises and skills worked on individually and in group-work, whether or not carried out under the supervision of an instructor, will also be assessed.

At the end of the semester there will be an examination relating to points covered during the whole course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	26	6	0.5	30	2.5	41.67	a,b,c,d
II. Practicals	2	20	1	30	2.12	35.33	a,b,c,d,e,f
III. Assessments	4	2	1.5	27	1.38	23	All
TOTAL	32	28	3	87	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In sessions of practical work in the classroom and the laboratory, the instructor will guide the students in the application of theoretical concepts to the solving of problems, encouraging critical thinking and team-work methods.

CONTENTS

I. Quantitative evaluation of computer performance.
II. Segmentation of processors.
III. Parallelism at instruction level.
IV. Multiprocessors.

DESCRIPTION OF SKILLS

a. Capacity to gain an awareness of, understand and evaluate the structure and architecture of computers, together with the basic components they comprise.
b. Capacity to analyse and solve problems.
c. Ability to interpret results.
d. Capacity to learn independently.
e. Ability to work as part of a group.
f. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
g. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.

SUBJECT DESCRIPTION TABLE

Subject Title	Introduction to Intelligent Systems
Subject Area	Intelligent Systems
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:
- In-class written tests.
- Work to be submitted.
- Complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	23	6	0.5	30	2.38	39.67	a,b,c,d
II. Practicals	4	20	0.5	40	2.58	43.00	All

III. Assessments	3	2	1	20	1.04	17.33	All
TOTAL	30	28	2	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, following guidelines supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and modelling them in the area of engineering, at all times encouraging critical thinking and the exchange of information between students.

CONTENTS

I. Intelligent systems: fundamentals, concepts and problems of interest.
II. Computer learning
III. Methods for supervised and unsupervised learning
IV. Experimental methods and analysis of results
V. Practical applications

DESCRIPTION OF SKILLS

a. Awareness and application of the fundamental principles and basic techniques of intelligent systems and their practical applications.
b. Capacity to organize and plan
c. Ability to learn independently
d. Capacity to analyse and synthesize.
e. Capacity for team work
f. Effective development of spoken and written communication.

SUBJECT DESCRIPTION TABLE

Subject Title	Distributed Systems
Subject Area	Communications Networks
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	Operating systems

METHOD OF ASSESSMENT

Assessment of student work, whether done during attendance at timetabled sessions or otherwise, and the skills acquired, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities:
- In-class written tests.
- Work to be submitted (software, written work and exercises)

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	25		0.4	25	2.0	33.6	a, c, e

II. Practicals		30	0.4	58	3.5	58.9	b, c, d, e
III. Assessments	5		0.2	6	0.5	7.5	a, b, c, e
TOTAL	30	30	1.2	89	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In type S sessions the instructor will guide the students to a practical understanding of the problems of working in distributed environments, such as synchronization, causal ordering and concurrency, transparency and error handling. The instructor will also give guidance on the implementation of algorithms to solve these, using parallel, concurrent, distributed and real-time programming systems, which in turn will serve to permit the development and implementation of distributed applications at the scale of the Internet.

CONTENTS

I. Concepts and structures of distributed systems
II. Communication between distributed processes
III. Distributed objects
IV. Planning in distributed operating systems
V. Distributed transactions
VI. Security in distributed systems

DESCRIPTION OF SKILLS

a. Knowledge and application of the characteristics, functionalities and structure of distributed systems, computer networks and the Internet and designing and implementing applications based on them.

b. Knowledge and application of the fundamental principles and basic techniques of parallel, concurrent, distributed and real-time programming

c. Capacity to learn independently.

d. Ability to work as part of a group.

e. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

f. Development of an intuitive awareness of the advantages and difficulties of distributed systems

SUBJECT DESCRIPTION TABLE

Subject Title	Project Management
Subject Area	Projects
Module	Common Core for Computing
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

Students' marks will be the result of assessment of:
- The theoretical knowledge they acquire.
- The quality of the work handed in as a consequence of tasks assigned.
- The degree to which good practice in project management is applied to the carrying out of the activities leading to the work submitted that is mentioned above.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	5	0.5	35	2.42	40.33	a, c, e
I. Practicals	10	15	0.5	35	2.42	40.33	all
I. Assessments	3	5	1	20	1.16	19.33	all
TOTAL	33	25	2	90	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In sessions of type S the instructor will aid the students in the working out of practical cases, at all times encouraging the application of the methods described in guides to good practice in project management produced by prominent international bodies

CONTENTS

I. Introduction to projects
II. The life-cycle of projects and their products or services
III. Evaluation of projects
IV. Development and management of projects

DESCRIPTION OF SKILLS

a. Capacity to plan, design, develop and direct computer projects, services and systems in all contexts, leading in setting them up and ensuring their continuing improvement, while assessing their economic and social impact.
b. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.
c. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.
d. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
e. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Information Systems I
Subject Area	Computing
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities:

- Work to be submitted at intervals, done individually or as a group.
- In-class written tests.
- Examinations.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
IV. Theoretical Studies	20	12	1	30	2.52	42.00	a, b, c, d, f
V. Practicals		20	1	35	2.24	37.33	a, c, d, e, f,
VI. Assessments	3	2	1	25	1.24	20.67	all
TOTAL	23	34	3	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

CONTENTS

I. Fundamentals of the organization of information systems.
II. Technical basis of information systems.
III. Systems for administrative support and improved decision-making in organizations.
IV. Construction of information systems.
V. Administration of information systems within an organization.
VI. The value of information systems.

DESCRIPTION OF SKILLS

a. Ability to select, develop, integrate and manage information systems meeting the needs of an organization, using the cost and quality criteria identified.

b. Capacity to understand the environment of an organization.

c. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.

d. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.

e. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

f. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Information Systems II

Subject Area	Computing
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities:

- Work to be submitted at intervals, done individually or as a group.
- In-class written tests.
- Examinations.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	12	1	30	2.52	42.00	all
II. Practicals		20	1	35	2.24	37.33	all
III. Assessments	3	2	1	25	1.24	20.67	all
TOTAL	23	34	3	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of practical cases, at all times encouraging critical thinking. Exercises will be set for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

CONTENTS

I. Applications of information systems.
II. Data warehousing. Process of data gathering.
III. Data mining.
IV. Executive information systems. Systems supporting decision-making.
V. Quality of information systems.
VI. Business intelligence.

DESCRIPTION OF SKILLS

a. Ability to select, design, develop, integrate, evaluate, build, manage, use and maintain hardware and software technologies, within appropriate cost and quality parameters.

b. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.

c. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.

d. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

e. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Software Engineering II
Subject Area	Software Engineering
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, either individually or in group work, will be achieved by assigning appropriate weightings to the following activities:
- Work completed individually or as a group.
- In-class written tests.
- Examinations.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	12	1	30	2.52	42.00	all
II. Practicals		20	1	30	2.04	34.00	all
III. Assessments	3	2	1	30	1.44	24.00	all
TOTAL	23	34	3	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the resolution of practical cases, at all times encouraging critical thinking. Exercises will be set for the students to solve, thus acquiring skill in the use of the tools necessary for solving problems

CONTENTS

I. Types of development: recommended methods.
II. Methods of information engineering
III. Modelling systems: cost/benefit analysis

IV. Advanced topics
DESCRIPTION OF SKILLS
a. Ability to understand the environment of an organization and its needs in the area of information communications technologies. b. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature. c. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience. d. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Computer Security
Subject Area	Security
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	Algebra, Algorithms, Discrete Mathematics

METHOD OF ASSESSMENT

Assessment of the subject corresponding to six credits will be as follows: 50% of the final mark will be allotted to the work presented by students in class, with emphasis given to the way in which this is explained and supported. The remaining portion of the final mark will be given for the completion of a practical computer-based examination in which the emphasis will be on programming, reasoning and the results obtained, with the exception of sections VII and VIII of the contents, for which only the first form of the method of assessment will apply.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	18	9	0.2	30.5	2.27	37.8%	a, d, e, f, g
2. Practicals		26.5	0.2	49.5	3.09	51.5%	All
3. Assessments	6			10	0.64	10.7	
TOTAL	24	35.5	0.5	90	6	100	

The timetabled sessions of teaching and learning activity given over to practicals will be divided into two main parts: attendance at “chalk and talk” practical classes, in which applications of the theory will be presented and exercises involving the techniques learnt will be worked out, and attendance at classes in the computer room, in which skill will be acquired in the handling of computer applications for symbolic calculation and programs typical of cryptography.

With regard to sections VII and VIII of the contents, practicals in seminar groups will be used

to carry out pieces of group-work.

CONTENTS

I. Introduction to the communication theory
II. Introduction to codes for error detection and correction
III. Linear code
IV. Classic and modern cryptography
V. Digital signature
VI. Other cryptographic protocols
VII. Detection of intrusions, forensic analysis and physical security
VIII. Legal aspects of computer security. Security audits.

DESCRIPTION OF SKILLS

a. Capacity to communicate in spoken and written form knowledge, procedures and ideas to all types of audience.
b. Capacity for team work, organizing, planning and distributing tasks among the various team members
c. Ability to cope with new situations involving the use of new knowledge and techniques, hence enhancing independent learning.
d. Ability to design, develop, select and evaluate computer applications and systems, ensuring their reliability, security and quality, in accordance with ethical principles, and current legislation and standards
e. Capacity to understand, apply and manage guarantee and security of computer systems.
f. Capacity to analyse and solve basic problems in the theory of codes and cryptography.
g. Aptitude in the correct handling of computer applications for symbolic calculation and programs typical of cryptography
h. Aptitude in the implementation of algorithms from the theory of codes and cryptography.
i. Ability to express ideas correctly in terms of computer security.
j. Capacity for critical thinking and self-critique

SUBJECT DESCRIPTION TABLE	
Subject Title	Network Architecture, Design and Management
Subject Area	Communications Networks
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	None

METHOD OF ASSESSMENT

All the activities undertaken and skills worked upon, both individually and in group-work, whether or not done with an instructor present, will be assessed.
The final mark will be the outcome of a combination of:
- Continuous assessment of work done.
- Marks from tests held.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)	ECTS	%	Related Skills

	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	16	10	0.5	37	2.54	42.33	a, b, e, g
II. Practicals	2	29	0.5	31	2.5	41.67	a, b, c, d
III. Assessments	2	1	1	20	0.96	16	All
TOTAL	20	40	2	88	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor. The intention is to ensure that they assimilate more efficiently the explanations given in teaching and learning activities of type C.

Of the teaching and learning activities programmed as involving only some of the students (type S in the table above) 50% will be undertaken in groups of five students. In these sessions students will be taught techniques both for team work and for independent study. The remaining 50% of the teaching and learning activities will be in groups of between 10 and 15 students.

CONTENTS

I. Architecture of computer networks: the layers model.

II. Phases and methods in the design of a network.

III. Designing topology and scale.

IV. Choice of technologies and devices. Aspects of security and cost.

V. Functional aspects of network management

VI. Network management models.

DESCRIPTION OF SKILLS

a. Knowledge and application of the characteristics, functionalities and structure of computer networks and the Internet.

b. Ability to select, design, develop, integrate, evaluate, build, manage, run and maintain network technologies, within appropriate parameters for cost and quality.

c. Capacity to select, design, develop, integrate and manage communications networks and infrastructures in an organization.

d. Capacity to learn independently through solving problems.

e. Development of the learning abilities necessary to undertake further studies.

f. Ability to work as part of a group.

g. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE

Subject Title	Web Applications
Subject Area	Internet Services
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester

Prerequisites	Programming I, Programming II, Internet Services

METHOD OF ASSESSMENT

To achieve a pass in this subject, students must complete a piece of work consisting of the application of the theoretical and practical knowledge studied to a specific practical case. This work will be undertaken in groups of medium size and assessment of it will be based on periodical follow-up in the form of interviews between the working group and the instructor.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	18		1	6	1	17	a, b
II. Practicals		40	0.5	79	4.8	80	a, b, c, d, e
III. Assessments	1	1	0.5	3	0.2	3	a, b, c
TOTAL	19	41	2	88	6	100	

About 90% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

The subject will follow the model of project-based learning. For this purpose, the theoretical and practical contents will be covered in such a way as to enhance the students' capacities for independent learning and planning. The instructor will indicate the requirements for the project considered necessary for students to gain the knowledge indicated in the subject objectives and will encourage active use of sources of information.

CONTENTS

I. Architecture of web applications
II. Logic of presentation – Client
III. Business model – Server logic
IV. Persistence – Managing the state of the system
V. Environments – Development, testing and running
VI. Roll-out

DESCRIPTION OF SKILLS

a. Capacity to design systems and applications based on web technologies.
b. Capacity to develop an electronic business application.
c. Ability to learn independently, take decisions, think critically and communicate in spoken and written form.
d. Capacity to organize and plan.
e. Ability to work in a team.

SUBJECT DESCRIPTION TABLE

Subject Title	Internet Services
Subject Area	Internet Services
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	Network Architecture, Design and Management

METHOD OF ASSESSMENT
All the activities undertaken and skills worked upon, both individually and in group-work, whether or not done with an instructor present, will be assessed. The final mark will be the outcome of a combination of: - Continuous assessment of work done. - Marks from tests held.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I.Theoretical Studies	16	10	0.5	37	2.54	42.33	a, c, e
II.Practicals	2	29	0.5	31	2.5	41.67	a, b, d
III.Assessments	2	1	1	20	0.96	16	All
TOTAL	20	40	2	88	6	100	

Students will spend part of their working time without an instructor on preparation for classes, reading materials previously indicated to them by the teaching staff so that they will be able to assimilate more efficiently the explanations given in teaching and learning activities of type C.

Of the teaching and learning activities programmed as involving only some of the students (type S in the table above) 50% will be undertaken in groups of five students. In these sessions students will be taught techniques both for team work and for independent study. The remaining 50% of the teaching and learning activities will be in groups of between 10 and 15 students.

CONTENTS

I. Architectures and types of network and Internet systems and services.
II. Remote connection service. Domain name service. File transfer service. Web service. Multimedia data transmission service. Other services.
III. Mobile computing

DESCRIPTION OF SKILLS

a. Capacity to design systems, applications and services based on network technologies, including the Internet, multimedia, interactive services and mobile computing.
b. Capacity to learn independently through solving problems.
c. Development of the learning abilities needed to undertake further study.
d. Ability to work as part of a group.
e. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Accessibility
Subject Area	Accessibility
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Seventh semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, whether individually or in group-work, will be

achieved by assigning an appropriate weighting to the following activities:

- Examinations.
- Work periodically submitted for marking, completed either individually or as part of a group.
- Items handed in for assessment.
- Spoken presentations.
- The compiling of a personal dossier which will bring together all the activities and information noted down in seminars during the course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	16	10	0.5	37	2.54	42.33	a, b, e
II. Practicals	2	29	0.5	31	2.50	41.67	a, b, c, d, f
III. Assessments	2	1	1	20	0.96	16.00	all
TOTAL	20	40	2	88	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In type S working sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and modelling them in the area of engineering, at all times encouraging critical thinking and the exchange of information between working groups..

CONTENTS

I. Introduction.
II. Interactive devices.
III. The human factor.
IV. Styles and paradigms of interaction.
V. Graphic design.
VI. User-centred analysis.
VII. Accessibility, ergonomics and usability.
VIII. Evaluation of a human-computer interface.

DESCRIPTION OF SKILLS

a. Capacity to employ user- and organization-centred methods to develop, evaluate and manage applications and systems based on information technology, so as to ensure the accessibility, ergonomics and usability of these systems.
b. Capacity to learn independently.
c. Ability to work as part of a group.
d. Capacity to organize and plan.
e. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Computational Complexity
Subject Area	Algorithms
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Seventh semester

Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted, such as essays and similar.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I.Theoretical Studies	18	8.5	0.25	30	2.27	37.8	a, b
II.Practicals	0	27		50	3.08	51.4	a, b, c
III.Assessments	6	0	0.25	10	0.65	10.8	a, b, c
TOTAL	24	35.5	0.45	90	6	100	

All student work with teachers will require attendance at timetabled sessions.

Whole-class sessions (C) comprise activities carried out in large groups of up to 75 students.

Seminar work (S) comprises activities carried out in "medium" groups of up to 25 students.

Tutorials (T) comprise activities carried out individually or in small group work in some cases.

CONTENTS

I. Introduction to computational complexity.
II. Turing machines.
III. Classes of complexity.
IV. Computable functions.
V. Applications to specific problems.

VI. DESCRIPTION OF SKILLS

a. Ability to solve the mathematical problems that may arise in engineering. Aptitude in applying knowledge of the computational complexity of a problem, discriminating between different types of complexity, recognizing computationally equivalent problems and being aware of algorithmic strategies likely to lead to their resolution (recommending, developing and implementing whichever provides the best performance).

b. Capacity to analyse problems in computer engineering and create mathematical solutions or models to solve them.

c. Ability to communicate, in written or spoken form, information, ideas, problems and solutions by means of mathematical language.

SUBJECT DESCRIPTION TABLE

Subject Title	Knowledge Engineering
Subject Area	Intelligent Systems
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6

Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

All the activities undertaken and skills worked upon, both individually and in group-work, whether or not done with an instructor present, will be assessed.
The final mark will be the outcome of a combination of:

- Continuous assessment of work done.
- Marks from tests held.

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	16	10	0.5	37	2.54	42.33	a, c, e
II.	Practicals	2	29	0.5	31	2.5	41.67	a, b, d
III.	Assessments	2	1	1	20	0.96	16	All
TOTAL		20	40	2	88	6	100	

Students will spend part of their working time without an instructor on preparation for classes, reading materials previously indicated to them by the teaching staff so that they will be able to assimilate more efficiently the explanations given in teaching and learning activities of type C.

Of the teaching and learning activities programmed as involving only some of the students (type S in the table above) 50% will be undertaken in groups of five students. In these sessions students will be taught techniques both for team work and for independent study. The remaining 50% of the teaching and learning activities will be in groups of between 10 and 15 students.

CONTENTS

I. Historical introduction to knowledge engineering.
II. Paradigms and formal representations of knowledge.
III. Tools and methods.
IV. Design and creation of applications by means of knowledge engineering.

DESCRIPTION OF SKILLS

a. Capacity to acquire, obtain, formalize and represent human knowledge in a computable form so as to solve problems by means of a computer system in any applications environment, particularly those relating to aspects of computation, perception and action in intelligent environments or contexts.
b. Capacity to learn independently through solving problems.
c. Development of the learning abilities needed to undertake further study.
d. Ability to work as part of a group.
e. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Information Systems for Management and Business Intelligence
Subject Area	Intelligent Systems
Module	Specific to ULE
Type	Optional

Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

- Written tests
- Technical report
- Presentations by students
- Oral tests.
- Exercises, tasks and assignments to be completed away from class
- Reports on simulations or practical workshops.
- Use of software
- Notes from each type of methodological strategy with the related critical analysis

The teaching and learning activities in which the students undertake any type of individual or team work will be assessed on the basis of a profile of skills drawn up specifically for that purpose, taking into account the student's technical capability, the work done, the documentation handed in (reports), the student's capacity for spoken expression and the abilities and attitudes shown during the course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	26	5	0.5	35	2.66	44.33	a, b, c, d (1 a 5),
2. Practicals	4	20	0.5	25	1.98	33.00	d, e, f, g, h, 6, 7
3. Assessments	4	1	1	28	1.36	22.67	all
TOTAL	34	26	2	88	6	100	

In accordance with the nature of the course, all the contents will be covered at the various levels of application, analysis, synthesis and evaluation, by means of activities designed to improve students' computing abilities in a progressive fashion. Particular stress will be laid on active methods and significant learning.

The principal methodological strategies and activities to be used in this subject so as to ensure that the students achieve learning targets are the following:

Methodological strategies	**Intended to develop**
1. Lectures	Cognitive processes
2. Directed study and workshops	Investigating, comparing, analysing, preparing overviews, enhancing the tools necessary for deduction and induction
3. Group work	Sharing ideas, taking decisions (also giving students the opportunity to put into practice tolerance and respect for others' opinions)
4. Case studies	Clarification and formalization of concepts, investigating, comparing, analysing, synthesizing and taking decisions
5. Panels, discussion and question-and-answer sessions	Discussing and sharing ideas (socializing actions) to develop analytic criteria for situations that often occur in real life.
6. Computer simulations	Creating or solving problems
7. Presentations	Oral skills

CONTENTS

Topic I: General theory of systems

Topic II: Information, administration and decision-making.

Topic III: Information systems in businesses.

Topic IV: Design and construction of information systems

Topic V: Business intelligence systems

Topic VI: Applications to business

Topic VII: Administration of information systems

DESCRIPTION OF SKILLS

General:

a) Ability to think (cognitive processes)

b) Clarification and formalization of concepts.

c) Discussion and sharing of ideas (socializing actions) to develop analytic criteria in situations that frequently occur in real life, in which students can put into practice tolerance and respect for others' opinions.

d) Investigating, comparing, analysing, preparing overviews (enhancing the tools necessary for deduction and induction)

e) Solving problems

f) Taking decisions

g) Use of technology

h) Team and collaborative work using the web.

Specific to subject:

1. Conceptualizing the fundamentals of information technology and information systems for business management and intelligence necessary for running enterprises.
2. Identifying information systems and their component parts.
3. Describing the process of administering information technology.
4. Analysing the requirements and implementation costs of an information system.
5. Classifying information systems in accordance with their applications and utility
6. Designing information systems for decision-making in business management and business intelligence.
7. Focusing the knowledge acquired on a real problem in business management, applying intelligent management systems to business solutions
8. Developing an intelligent management system project at the outline level for various business environments
9. Awareness of ethical values when using intelligent management systems
10. Describing security systems in intelligent management systems

SUBJECT DESCRIPTION TABLE	
Subject Title	Language Processors
Subject Area	Language Processors
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Eighth semester

Prerequisites	None

METHOD OF ASSESSMENT

Written examinations and/or work set, together with a final assignment of substantial extent.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	12	1	27	2.4	40	a, c, d, e
II. Practicals		18	1	34	2.1	35	b, c, f
III. Assessments	3	3	2	29	1.5	25	All
TOTAL	23	33	4	90	6	100	

It is desirable for students to have a moderate knowledge of programming, data structures and the theory of formal languages and automata.

All student work with an instructor will require attendance at timetabled sessions.

For slots of types C and S indications will be given in advance of reading material to which references will be made during the presentation of the topics to be explained.

In working sessions of type S (seminars) more specialized topics will be covered in order to provide a greater foundation of knowledge more specific to the final task.

CONTENTS

I. Language processors: functions, logical and physical structures and types.
II. Analysis phase: lexis, syntax and semantics
III. Synthesis phase. Execution environment. Generation and optimization of code.
IV. General procedures and tools for constructing language processors.
V. Types of language processor and production tools based on languages and their processors

DESCRIPTION OF SKILLS

a. Capacity to gain awareness of the theoretical bases of programming languages and the associated techniques for lexical, syntactic and semantic processing, and knowledge of how to apply to the creation, design and processing of languages
b. Ability to apply the theory of languages to the construction of a language processor.
c. Ability to evaluate the suitability of a language and its implementation for an area of application.
d. Capacity to find and assess solutions to problems of language processors.
e. Ability to evaluate the constructions of a programming language with respect to the cost of the work of a language processor.
f. Capacity to understand and use reference manuals for programming languages

SUBJECT DESCRIPTION TABLE	
Subject Title	English
Subject Area	English
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	Knowledge of general English at an intermediate level

METHOD OF ASSESSMENT

Assessment of student work (whether completed during attendance at timetabled slots or otherwise) and of the skills acquired will be achieved by allotting suitable weightings to the following activities:
- Work for submission at intervals, whether completed individually or in a group
- Oral presentations
- Complementary activities
- Examinations

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I.Theoretical Studies	24		0.2	20	1.77	29.5	a, b
II.Practicals	10	16	0.6	40	2.66	44.33	b, c
III.Assessments	9		0.2	30	1.57	26.17	All
TOTAL	43	16	1	90	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication.

CONTENTS

I. Technical vocabulary for computer science engineers. Acronyms and abbreviations. Word formation: conversion, affixation and compounds. Collocations.

II. Grammar and use of language in technical discourse. Relationships between technical discourse and grammar.

III. The structure of the technical paragraph. Natural patterns: time order, space order, causality and result. Logical patterns: order of importance, comparison and contrast, analogy and exemplification. Discourse cohesion.

IV. Rhetorical functions: definitions, descriptions, classifications, instructions, visual-verbal relationships.

V. Professional communication in technical environments: reports, abstracts, articles, case studies, manuals, oral presentations, memos, CVs and application letters, face-to-face interactions, phone calls, online communications.

DESCRIPTION OF SKILLS

a. Capacity to understand various different types of texts in the technical English of computing, both spoken and written, recognizing specific terminology, grammatical structures and textual conventions characteristic of the information technology sector.

b. Capacity to gain the skills needed to draw up, in English, reports, technical specifications, correspondence with manufacturers, suppliers and customers, project presentations for meetings, consultations in international technical forums and other documents relating to the performance of tasks typically facing graduates in computing.

c. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

SUBJECT DESCRIPTION TABLE

Subject Title	Neural and Evolutionary Computation
Subject Area	Mathematics
Module	Specific to ULE
Type	Optional

Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Work to be submitted, such as essays and exercises.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Studies	15	3	0.5	21	1.58	26.3	a, b
II. Practicals	3	20		63	3.44	57.4	a, b, c, d
III. Assessments	6	12	0.5	6	0.98	16.3	a, b, c, d
TOTAL	24	35	1	90	6	100	

All student work with teachers will require attendance at timetabled sessions.

Whole-class sessions (C) comprise activities carried out in "large" groups of up to 75 students.

Seminar work (S) comprises activities carried out in "medium" groups of up to 25 students.

Tutorials (T) comprise activities carried out individually or in small group work in some cases.

CONTENTS

I. Introduction to computing based on biological models.
II. Neural networks.
III. Evolutionary computing.
IV. Applications to the solving of problems in engineering and biotechnology.

DESCRIPTION OF SKILLS

a. Capacity to solve the mathematical problems that may arise in engineering and (bio)technology. Ability to apply knowledge of the principles, mathematical foundations and evolutionary techniques, and their applications to the resolution of problems of optimization and classification.

b. Capacity to analyse problems in computer engineering and to bring together solutions or mathematical models to solve them.

c. Demonstration by the students that they possess and understand information from a field of study going beyond the basis gained in general secondary education and which is of a standard such that, while based on higher-level textbooks, also includes certain aspects that imply knowledge gained from the cutting edge of their field of study.

d. Capacity for critical thinking and self-critique.

SUBJECT DESCRIPTION TABLE

Subject Title	Specific and Nested Architectures
Subject Area	Computers
Module	Specific to ULE

Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Computer Architectures, Operating Systems

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Group presentations and work.
- Items to be submitted (software, written work or exercises).

TEACHING AND LEARNING ACTIVITIES

Type of Activity		Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
		With Instructor			Without Instructor			
		C	S	T				
I.	Theoretical Studies	25		0.25	25	2	33.3	All
II.	Practicals		28	0.5	42	2.8	46.7	All
III.	Assessments	5	2	0.25	22	1.2	20	All
TOTAL		30	30	1	89	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom and laboratory practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and writing of programs, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems and writing programs.

CONTENTS

1. Characterization of specific and real-time systems
2. Architecture of specific computers
3. Operating systems for nested and real-time systems
4. Programming languages for systems
5. Execution environments.
6. Development of software for nested systems.

DESCRIPTION OF SKILLS

a. Capacity to develop specific processors and nested systems.

b. Capacity to develop and optimize software for specific processors and nested systems.

c. Capacity to analyse and solve problems.

d. Capacity to interpret results.

e. Ability to work as part of a group.

f. Effective development of spoken and written communication.

g. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given

viewpoints and to solve problems within their field of study.

h. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.

SUBJECT DESCRIPTION TABLE	
Subject Title	Grid Computing and Supercomputing
Subject Area	Computers
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Computer Architectures, Operating Systems

METHOD OF ASSESSMENT

Assessment will be by tests spread out over the whole semester, coinciding with the ends of homogeneous blocks of presentation of material. Exercises and skills worked on individually and in group-work, whether or not carried out under the supervision of an instructor, will also be assessed.

At the end of the semester there will be an examination relating to points covered during the whole course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	30		1.25	30	2.45	40.8	All
II. Practicals		30	1.25	30	2.45	40.8	All
III. Assessments	2.5	2.5	0.5	22	1.1	18.4	All
TOTAL	32.5	32.5	3	82	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom and laboratory practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and the writing of programs, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems and writing programs.

CONTENTS

1. Parallel architectures. Vector and matrix processors.
2. Grid computing: fundamentals and technologies.
3. Supercomputing: fundamentals and technologies.
4. Applications of grid computing and supercomputing.

DESCRIPTION OF SKILLS

a. Identification and description of the principal models of parallel architectures.

b. Identification and description of the principles and basic technologies of grid

computing and supercomputing, together with those scientific and industrial applications in which their use is of particular interest.

c. Capacity to analyse and solve problems.

d. Capacity to interpret results.

e. Ability to work as part of a group.

f. Effective development of spoken and written communication.

g. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.

h. Capacity of students to gather and interpret relevant data (normally from within their field of study) so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.

SUBJECT DESCRIPTION TABLE	
Subject Title	Security in Communications Networks
Subject Area	Security
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Network Architecture, Design and Management

METHOD OF ASSESSMENT

All the activities undertaken and skills worked upon, both individually and in group-work, whether or not done with an instructor present, will be assessed.
The final mark will be the outcome of a combination of:

- Continuous assessment of work done.
- Marks from tests held.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	16	10	0.5	37	2.54	42.33	a, c, e
II. Practicals	2	29	0.5	31	2.5	41.67	a, b, d
III. Assessments	2	1	1	20	0.96	16	All
TOTAL	20	40	2	88	6	100	

Students will spend part of their working time without an instructor on preparation for classes, reading materials previously indicated to them by the teaching staff so that they will be able to assimilate more efficiently the explanations given in teaching and learning activities of type C.

Of the teaching and learning activities programmed as involving only some of the students (type S in the table above) 50% will be undertaken in groups of five students. In these sessions students will be taught techniques both for team work and for independent study. The remaining 50% of the teaching and learning activities will be in groups of between 10 and 15 students.

CONTENTS
I. Vulnerabilities presented by communications networks. II. Prevention mechanisms. III. Study of the various architectures, technologies and tools offering security in a network environment. IV. Systems for detecting intrusions.
DESCRIPTION OF SKILLS
a. Ability to manage security in communications networks. b. Capacity to learn independently through solving problems. c. Development of the learning abilities needed to undertake further study. d. Ability to work as part of a group. e. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Mobile and Wireless Networks
Subject Area	Communications Networks
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Network Architecture, Design and Management

METHOD OF ASSESSMENT

All the activities undertaken and skills worked upon, both individually and in group-work, whether or not done with an instructor present, will be assessed.
The final mark will be the outcome of a combination of:

- Continuous assessment of work done.
- Marks from tests held.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I.Theoretical Studies	16	10	0.5	37	2.54	42.33	a, b, c, d ,e.
II.Practicals	2	29	0.5	31	2.5	41.67	b, d, e, f, g, h,
III.Assessments	2	1	1	20	0.96	16	All.
TOTAL	20	40	2	88	6	100	

Students will spend part of their working time without an instructor on preparation for classes, reading materials previously indicated to them by the teaching staff so that they will be able to assimilate more efficiently the explanations given in teaching and learning activities of type C.

Of the teaching and learning activities programmed as involving only some of the students (type S in the table above) 50% will be undertaken in groups of five students. In these sessions students will be taught techniques both for team work and for independent study. The remaining 50% of the teaching and learning activities will be in groups of between 10 and 15 students.

CONTENTS
I. Evolution and classification.
II. Models and architectures.
III. Access technologies, devices and protocols.
IV. Applications and services.
V. Fundamentals of QoS (quality of service).
VI. Security in mobile and wireless networks.
DESCRIPTION OF SKILLS
a. Knowledge and applications of the peculiarities and characteristics of wireless networks for data transmission in respect of their design.
b. Configuration and use of the different technologies relating to this type of network.
c. Knowledge and applications of the security policies critical in this type of network.
d. Capacity to set up solutions based on wireless communications systems.
e. Awareness of the set of services offered by this type of network.
f. Capacity to learn independently through solving problems.
g. Development of the learning abilities needed to undertake further study.
h. Ability to work as part of a group.
i. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Artificial Vision
Subject Area	Applications
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT
Assessment of student work and the skills acquired, either individually or in group work, whether during attendance at timetabled sessions or otherwise, will be achieved by assigning appropriate weightings to the following activities: - In-class written tests. - Work to be submitted. - Oral presentations. - Other complementary activities.

TEACHING AND LEARNING ACTIVITIES						
Type of Activity	Student Work Hours (25 per ECTS credit)			ECTS	%	Related Skills
	With Instructor		Without Instructor			
	C	S T				

I. Theoretical Studies	20		0.2	30.5	2.03	33.83	a, b, c, e, f, g
I. Practicals		36	0.2	30	2.65	44.17	a, c, d, f, g, h,
I. Assessments	2	2	1.1	28	1.32	22.00	all
TOTAL	22	38	1.5	88.5	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In classroom theoretical sessions, the instructor will present the concepts, methods and fundamental problems of the subject, by means of theoretical explanations and illustrative examples.

In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Students will be given guidelines to allow them to cover step by step the various concepts covered in each practical session. These sessions will guide them in learning the various techniques for the digital processing of images and pattern recognition through simple algorithms that students will use and in some instances program.

Students will also have to complete at least one mini-project on a topic set by the instructor and will have to speak about this project in a class session.

CONTENTS

I. Image acquisition systems
II. Basic concepts of digital images
III. Operations on images: pre-processing
IV. Automatic image processing: segmentation, representation and description
V. Pattern recognition

DESCRIPTION OF SKILLS

a. Capacity to design systems for image acquisition and processing, and use them to analyse image contents.

b. Ability to work out which problems can be solved by means of techniques of artificial vision

c. Ability to assess artificial vision systems and the benefits of their application

a. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.

a. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

d. Development by students of the learning abilities needed to undertake further study with a high degree of autonomy.

e. Capacity for team work.

f. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE

Subject Title	Techniques for Semantic Modelling on the Web
Subject Area	Applications
Module	Specific to ULE
Type	Optional

Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

All the activities undertaken and skills worked upon, both individually and in group-work, whether or not done with an instructor present, will be assessed.
The final mark will be the outcome of a combination of:

- Continuous assessment of work done.
- Marks from tests held.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I.Theoretical Studies	16	10	0.5	37	2.54	42.33	a, c, e
II.Practicals	2	29	0.5	31	2.5	41.67	a, b, d
III.Assessments	2	1	1	20	0.96	16	All
TOTAL	20	40	2	88	6	100	

Students will spend part of their working time without an instructor on preparation for classes, reading materials previously indicated to them by the teaching staff so that they will be able to assimilate more efficiently the explanations given in teaching and learning activities of type C.

Of the teaching and learning activities programmed as involving only some of the students (type S in the table above) 50% will be undertaken in groups of five students. In these sessions students will be taught techniques both for team work and for independent study. The remaining 50% of the teaching and learning activities will be in groups of between 10 and 15 students.

CONTENTS

I. Introduction to semantic techniques for modelling knowledge.
II. Fundamentals, methods and tools.
III. Semantic annotation of contents.
IV. Applications on the Internet and web services.
V. Other applications.

DESCRIPTION OF SKILLS

a. Ability to understand the techniques, methods and tools relating to the modelling of knowledge and know-how for designing and creating applications using these techniques to represent, integrate, seek and recover complex information, in particular in an Internet or web service environment.
b. Capacity to learn independently through solving problems.
c. Development of the learning abilities needed to undertake further study.
d. Ability to work as part of a group.
e. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE

Subject Title	Computer Animation
Subject Area	Applications
Module	Specific to ULE
Type	Optional

Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, whether individually or in group-work, will be achieved by assigning an appropriate weighting to the following activities:

- Examinations.
- Work periodically submitted for marking, completed either individually or as part of a group.
- Spoken presentations.
- The compiling of a personal dossier which will bring together all the activities and information noted down in seminars during the course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	16	10	0.5	37	2.54	42.33	a, b, e
II. Practicals	2	29	0.5	31	2.50	41.67	a, b, c, d, e
III. Assessments	2	1	1	20	0.96	16.00	all
TOTAL	20	40	2	88	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

In work sessions of type S, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and modelling them in the area of engineering, at all times encouraging critical thinking and the exchange of information between working groups.

CONTENTS

I. Introduction.
II. Models and operations.
III. Modelling techniques.
IV. Materials and textures.
V. Lighting and cameras.
VI. Animation techniques.

DESCRIPTION OF SKILLS

a. Capacity to understand and knowledge of how to apply techniques for three-dimensional design, modelling and animation of objects, as also how to undertake all the stages of an audiovisual production project in real contexts.
b. Ability to learn independently.
c. Ability to work as part of a group.
d. Capacity to apply theory in practice.
e. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE

Subject Title	Computing Applied to Automation and Control

Subject Area	Applications
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and skills exercised both individually and in group-work, whether or not with the instructor, will be assessed, using ICTs to record as far as possible the work carried out by each student.

The final mark will include as components:

- Credit for the continuing activities undertaken by students, through the use of technological means that will be provided to record and assess objectively the personal effort put into to the course.
- The marks obtained in various tests, which may or may not be in-class work and may be collective or individual and which will occur at intervals during the whole course. The greatest weight will be assigned to a final examination, requiring attendance and involving all candidates, designed to evaluate the skills acquired by students.
- A mark for a personal dossier which will bring together all the activities and information noted down during the course.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	32.0		1.0	34.0	2.68	44.67	a, b
II. Practicals		27.0	1.0	22.0	2.00	33.33	c, d, e, f, g, h
III. Assessments	4.0	2.0	1.0	26.0	1.32	22.00	All
TOTAL	36.0	29.0	3.0	82.0	6.00	100.0	

Student working time will be devoted to:

WORKING WITHOUT THE TEACHER

- Approximately 5% of student working hours will be spent on preparation for classes, reading material from a list supplied in advance by the instructor.
- Between 35% and 40% of these hours will be given over to studying and assimilating the theoretical materials covered with the instructor either during attendance at classes or through remote links permitting access to resources relating to the subject.
- Approximately 20% to 25% of such hours will be spent on acquiring practical skills by using laboratories either in person or via the Internet, in accordance with the availability of resources.
- Between 30% and 40% of student working hours will be devoted to tasks involving self-assessment and learning through technical means based on ICTs that will be made available, together with any other resources that students find necessary.

WORKING WITH THE TEACHER

- Approximately 92% of student work with instructors will involve attendance at timetabled sessions. The rest will be undertaken by means of the use of tools for long-distance communication. Nonetheless, to the extent that this is possible such use of tools for long-distance communication will be enhanced, so that student-teacher links will be more effective in regard of the management of teaching and learning: agreeing dates and times for tutorials, notifying deadlines for the handing in of work and announcing events of all sorts (lectures, talks, visits to industrial establishments and so forth).

- In type C sessions, the instructor will, when this appears appropriate, make use of technologies for remote access so as to illustrate theoretical concepts with practical industrial applications, thus achieving a complete blending of theory and practice.
- In S-type sessions, the instructor will guide the students in the application of theoretical concepts and results to the resolution of problems and their modelling in the field of automation. In this way, encouragement will at all times be given to critical thinking and the exchange of information between working groups and the concepts studied will be applied to the greatest possible number of specific cases. This will allow consolidation of the knowledge acquired (remote laboratory technology is used to access the greatest possible number of different industrial problems) and bring about a greater level of abstraction in students' ideas, with the creation of case-based structures of reasoning.

Activities referred to in this document as not requiring attendance or involving remote access will be undertaken by means of the Remote Automation Laboratory of the University of Leon. **http://lra.unileon.es**

CONTENTS
I. Introduction to automation and control systems. II. Data acquisition and processing in automation systems. III. Control strategies. IV. Architecture and programming of programmable logic controllers. V. Software applications for automation, control and monitoring.

DESCRIPTION OF SKILLS
a. Capacity to use and apply computer tools for automation, control and monitoring systems.
b. Knowledge of the fundamentals of automation and control engineering.
c. Capacity to design and implement programs that can be executed on programmable robots.
d. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of automation, control and monitoring systems.
e. Ability to handle environments based on new information and communication technologies (NICTs) and the associated emergent technologies.
f. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
g. Ability to adopt a critical attitude to previously used solutions, so as to encourage deeper study and analysis of the topics covered by this subject.
h. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Technological Innovation
Subject Area	Applications
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	
METHOD OF ASSESSMENT	

The undertaking of a group-work project on one of the practices in the subject area. Credit will be given for the outline developed, the use of different bibliographic sources, the degree of elaboration, the precision in the use of technical and scientific language, and the quality of the public presentation.

TEACHING AND LEARNING ACTIVITIES							
Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	15		1	46	2.48	41.33	a
II. Practicals		15	1	60	3.04	50.67	a,b,c,d,e,f
III. Assessments	5		1	6	0.48	8	a,b,c,d,e,f
TOTAL	20	15	3	112	6		

CONTENTS

1. Definition and concept of innovation. Types of innovation.
2. The process of innovation.
3. Managing Innovation.
4. The role of computing in innovation.
5. Analysis of examples.
6. Practical work on the development of innovatory processes, study and evaluation of such processes.

DESCRIPTION OF SKILLS

a. Capacity to understand and apply the principles and techniques of quality management and technological innovation in organizations.
b. Ability of students to express themselves accurately in terms of technological innovation.
c. Ability of students to **apply their knowledge to their work** or vocation in a professional manner, to demonstrate their skills by **formulating and arguing in favour of given viewpoints and solving problems** within their field of study.
d. Capacity of students to **gather and interpret relevant data** (normally from within their field of study) so as to be able to form and **express opinions** involving thought about appropriate topics of a social, scientific or ethical nature.
e. Ability to **transmit** information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
f. Capacity to develop the learning abilities needed to **undertake further study** with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Work Placement
Subject Area	Work Placement
Module	Specific to ULE
Type	Optional

Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Successful completion of 65% of the credits for the programme.

METHOD OF ASSESSMENT

The final mark will take into consideration:

- Continuous assessment, based on the attitudes and aptitudes demonstrated by students in working in the subject area.
- Tasks completed.
- The report submitted by the organization external to the university
- Quality of the student's report. Presentation of, and speaking to, this report (structure, clarity, expression and the like.).

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 per ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	0	0	4	18	0.88	14.67	b
II. Practicals	8	0	12	77	3.88	64.67	a, b, c, d, e
III. Assessments	0	0	1	30	1.24	20.67	all
TOTAL	8	0	17	125	6	100.00	

Work done for this subject may be related to the Final Year Project.

This subject involves the undertaking of tasks by students under the supervision of one tutor from the university and one from an external organization. This may or may not require attendance at timetabled sessions.

The tasks undertaken during work placements may be individual or group work. In the case of group work, differentiated tasks or objectives will be assigned in such a way as to permit individual presentation and marking.

Students will be required to produce a report and a spoken presentation on the work that they complete, detailing the objectives, methodology used, results and conclusions.

CONTENTS

Students will put into practice the knowledge and capacities they have acquired over the course of the degree programme by undertaking a piece of work in the field of computing within an external organization in the computer sector. Students will in this way round out the training received during the degree course, acquiring the methods and abilities necessary for the successful completion of a real task in a professional context.

Undertaking this work within such organizations will allow the students to collaborate directly with highly qualified professionals on cutting-edge topics and with the most advanced technologies available.

DESCRIPTION OF SKILLS

a. Capacity to develop working practices typical of the professional context in computing.
b. Capacity to analyse and bring together information from the professional environment of computing.
c. Capacity to plan and organize the progress of a piece of work.
d. Capacity to work independently or as part of a group.
e. Capacity to communicate in spoken and written form in a professional context.

SUBJECT DESCRIPTION TABLE	
Subject Title	Final Year Project
Subject Area	Final Year Project
Module	Final Year Project
Type	Compulsory
Number of ECTS Credits	12
Scheduling	Seventh and eighth semester
Prerequisites	Those laid down by internal regulations of the School or University

METHOD OF ASSESSMENT

Presenting and speaking to a paper before a university board of examiners.
The presentation of the Final Year Project requires prior checking that the formal features of documentation for it have been properly completed, so as to ensure that it conforms to the regulations currently in force.
Students will present their Final Year Projects over a maximum time of one hour. After the presentation, students they will argue in favour of their Final Year Projects in a debate in which the members of the board of examiners will be able to ask whatever questions they deem appropriate for a maximum time period of one hour.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	3		7	100	4.4	36.67	All
II. Practicals			10	100	4.4	36.67	All
III. Assessment			10	70	3.2	26.67	All
TOTAL	3		27	270	12	100	

Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be undertaken by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

During tutorial sessions the instructor will present the concepts, results and methods of the subject, using explanations and examples by way of illustration.

It is estimated that one hour of T-type work will be required to complete the formal documentation required.

This piece of work may be completed in other institutions or businesses, in which case the student will have one tutor from the University of Leon and another tutor from the institution or the business concerned.

CONTENTS

I. Students will undertake an original piece of work to be done on an individual basis and will present and speak to it before a university board of examiners. This will consist of a project in the area of the technologies specific to computer engineering of a professional nature, which will bring together and integrate the skills acquired during the programme of studies.

II. Patents and intellectual property

DESCRIPTION OF SKILLS

a. An original piece of work to be completed on an individual basis and presented to a university board of examiners, where the student will speak to the paper presented. It will consist of a project in the area of the technologies specific to computer engineering of a professional nature,

which will bring together and integrate the skills acquired during the programme of studies.

2.7 Mechanisms for the Co-ordination of Teaching

A board will be established to co-ordinate teaching of the syllabus. It will oversee:

- Horizontal Co-ordination (semesters).
    - Ensuring the real workload for students in each of the subjects matches what is laid down in the syllabus.
    - Timetabling of the various teaching and learning activities, including on-going instruction, for the set of subjects in any given semester.
- Vertical Co-ordination (whole programme).
    - Ensuring the coherence of the sequence of instruction in the syllabus.

Assessing the progression of outcomes of learning by students, who must acquire the competences appropriate to the qualification.