University of Leon

Graduate in Engineering in Industrial Electronics and Automation

Memorandum

School of Industrial and Computer Engineering

2009

Contents

1 Description of the Qualification

1.1 Name of the Qualification

- Graduate in Industrial Electronics and Automation 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 Technical Industrial Engineer, Specialism Electricity, Further Specialism

Electronics, Regulation and Automated Devices, currently taught at the University of Leon.

- Over the last five years the average enrolment for that qualification was 70 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 Coordination 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, save 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 the subject in question. 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 Industrial Engineer. (As indicated in the *Boletín Oficial de Estado* [Spanish Official Gazette] of Friday 20 February 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

- General Electronics
- Power Electronics
- Electronic Instrumentation
- Microprocessors
- Automation
- Control Engineering

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 Industrial Engineer,* the course of studies is divided into the following Modules:

Module		ECTS
Basic Core [Core]		60
Common Core for Industrial Subjects		60
Specific Technology (Industrial Electronics)		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.	Core
Physics	12	• An understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to resolving problems specific to engineering.	Core
Chemistry	6	• Ability to understand and apply the principles of basic knowledge of general, organic and inorganic chemistry and its applications in engineering.	Core
Graphic Design	6	• Capacity for spatial visualization and knowledge of the techniques for graphic representation, using both traditional methods from metric geometry and descriptive geometry, and by means of applications of computer-aided design.	Core
Computing	6	• Basic knowledge of the use and programming of computers, operating systems, databases and computer programs with applications to engineering.	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 Industrial Subjects

Subject Area	ECTS	Skills	Type
Physics	12	•Knowledge of applied thermodynamics and heat transmission. Basic principles and their application to solving problems in engineering. •Knowledge of the basic principles of fluid mechanics and their application to the resolution of problems in the field of engineering. Calculations for pipes, channels and fluid systems.	Comp
Chemical engineering	6	• Basic knowledge and application of environmentally-friendly technologies and sustainability.	Comp
Resistance of Materials	6	Knowledge and use of the principles of resistance of materials.	Comp
Mechanical and Fabrication Engineering	12	• Knowledge of the fundamentals of the science, technology and chemistry of materials. Understanding of the relationship between microstructure, synthesis or processing and the properties of materials. • Knowledge of the principles of the theory of machines and mechanisms. • Basic knowledge of systems of production and manufacture.	Comp
Electrical Engineering	6	• Knowledge and use of the principles of circuit theory and electric machines.	Comp
Electronics	6	• Knowledge of the fundamentals of electronics.	Comp
Automation	6	• Knowledge of the fundamentals of automatic apparatus and control methods.	Comp
Projects	6	•Knowledge and ability to organize and manage projects. Awareness of the organizational structure and functions of a project office. •Applied knowledge of business organization.	Comp

Module: Specific Technology (Industrial Electronics)			
Subject Area	ECTS	Skills	Type
Electrical Engineering	6	• Applied knowledge of electrical technology.	Comp
Electronics	24	• Knowledge of the fundamentals and applications of analog electronics. • Knowledge of the fundamentals and applications of digital electronics and microprocessors. • Applied knowledge of power electronics. • Applied knowledge of electronic instrumentation. • Ability to design analog, digital and power electronic systems.	Comp
Automation	18	• Knowledge and ability to model and simulate systems. • Knowledge of automatic regulation and control techniques and their application to industrial automation. • Knowledge of the principles and applications of robot systems. • Applied knowledge of industrial computing and communication. • Ability to design systems for control and industrial automation.	Comp

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type
Mathematics	6	•Ability to apply knowledge of complex variables. •Ability to analyse and synthesize mathematical methods applied to control engineering; in particular, Laplace transforms, Z transforms, Fourier analysis and state variables.	Comp
Graphic Design	6	•Ability to represent systems in space. •Ability to normalize representation and draw sets. •Ability to use tools for computer-aided graphic design in the manufacture of integrated circuits.	Comp
English	6	•Ability to acquire the structural, grammatical and terminological knowledge and strategies that will allow understanding of texts in English relating to the field of Electronic Engineering. •Ability to acquire the necessary skills to draw up and use specifications, reports and similar items written in English. •Ability to communicate and transmit knowledge, abilities, skills and versatility in the field of Electronic Engineering such as to allow students to work in a multilingual and multidisciplinary context.	Comp
Electrical Engineering	6	• Knowledge, handling and application of electric motors in the automation and control of industrial processes. • Knowledge of electric machines and actuators and their applications.	Comp
	12	• Ability to calculate low-voltage electrical installations. • Applied knowledge of renewable energies. • Ability to adjust protection in electric installations.	Opt
Communications	18	•Theoretical and applied knowledge of network architecture •Applied knowledge of Internet services •Applied knowledge of wireless communications networks • Theoretical and applied knowledge of current telecommunications systems, networks and services applicable to industrial electronics. •Knowledge of interfaces, protocols, modulation techniques, equipment, systems and technologies for transmitting analog and digital signals applicable in industrial electronics.	Opt
Electronic Systems	12	•Ability to specify, design and calibrate instrumentation used in electronics. Knowledge of systems for data acquisition, sensors, transducers, processing and handling signals and for error estimation. •Ability to specify, design, simulate and implement circuits, equipment and electronic systems using analog, digital, pulsed, added-intelligence, power and mixed techniques. •Knowledge of the technologies for manufacturing and assembling, design tools and simulation for the electronic components, integrated circuits, hybrid modules and printed circuit boards that make up electronic systems.	Opt
Intelligent Systems in Engineering	12	•Applied knowledge of artificial intelligence techniques in engineering. •Applied knowledge of nanotechnology in engineering. •Ability to design household and integral-building automation installations •Ability to carry out technical inspections and maintenance of household and integral-building automation installations	
Advanced Control	18	•Knowledge of algorithms for identification, optimization and control of systems and processes. •Ability to implement technological strategies for control in both industrial and non-industrial processes •Knowledge of the typical instrumentation used in industrial systems and processes •Ability to calculate, fix parameters, adjust and calibrate industrial instrumentation •Ability to design monitoring systems for industrial processes, both locally and remotely run •Knowledge of the classic and emerging technologies applied to monitoring or supervisory systems.	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 Computer Engineering
   - 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	Linear Algebra and Geometry	6	Core
		Differential and Integral Calculus	6	
		Mathematical Methods in Engineering	6	
		Numerical and Statistical Methods	6	
Physics	12	Basic Physics	6	Core
		Heat, Electricity and Magnetism	6	
Chemistry	6	Chemistry	6	Core
Graphic Design	6	Graphic Design I	6	Core

Module: Basic Core				
Subject Area	ECTS	Subjects	ECTS	Type
Computing	6	Computing	6	Core
Business Studies	6	Fundamentals of Business Administration	6	Core

Module: Common Core for Industrial Subjects				
Subject Area	ECTS	Subjects	ECTS	Type
Physics	12	Thermodynamics	6	Comp
		Mechanical Engineering of Fluids	6	
Chemical Engineering	6	Environmentally Friendly Technology	6	Comp
Resistance of Materials	6	Resistance of Materials	6	Comp
Mechanical and Fabrication Engineering	12	Materials Technology	6	Comp
		Technology of Fabrication and Machines	6	
Electrical Engineering	6	Principles of Electric Machines and Circuits	6	Comp
Electronics	6	Technology and Fundamentals of Electronics	6	Comp
Automation	6	Automation I	6	Comp
Projects	6	Project Management	6	Comp

Module: Specific Technology (Industrial Electronics)				
Subject Area	ECTS	Subjects	ECTS	Type
Electrical Engineering	6	Basic Electric Technology	6	Comp
Electronics	24	Electronic Instrumentation	6	Comp
		Analog Electronics	6	
		Digital Electronics	6	
		Power Electronics	6	
Automation	18	Automation II	6	Comp
		Control Engineering I	6	
		Control Engineering II	6	

Module: Courses Specific to ULE				
Subject Area	ECTS	Subjects	ECTS	Type
Mathematics	6	Complex Variables	6	Comp
Graphic Design	6	Graphic Design II	6	Comp
English	6	English	6	Comp
Electrical Engineering	6	Electric Motors and Actuators	6	Comp
	12	Electrical Measurements and Protection	6	Opt

Module: Courses Specific to ULE				
Subject Area	ECTS	Subjects	ECTS	Type
		Electric Installations and Renewable Generation	6	
Communications	18	Telecommunications in Industry	6	Opt
		Internet Services and Wireless Networks	6	
		Communications Networks	6	
Electronic Systems	12	Development and Construction of Prototypes	6	Opt
		Instrumentation, Remote Control and Telemetry	6	
Intelligent Systems in Engineering	12	Artificial Intelligence and Nanotechnology	6	Opt
		Household and Integral Building Automation	6	
Advanced Control	18	Industrial Instrumentation	6	Opt
		Industrial Monitoring	6	
		Control Techniques	6	

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
Linear Algebra and Geometry	6	Numerical and Statistical Methods	6
Differential and Integral Calculus	6	Heat, Electricity and Magnetism	6
Basic Physics	6	Graphic Design II	6
Chemistry	6	English	6
Graphic Design I	6	Computing	6

TOTAL	30	TOTAL	30

Second Year			
Third Semester		Fourth Semester	
Subject	ECTS	Subject	ECTS
Resistance of Materials	6	Automation I	6
Mathematical Methods in Engineering	6	Complex Variables	6
Principles of Electric Machines and Circuits	6	Thermodynamics	6
Electronic Instrumentation	6	Technology and Fundamentals of Electronics	6
Fundamentals of Business Administration	6	Materials Technology	6
TOTAL	30	TOTAL	30

Third Year			
Fifth Semester		Sixth Semester	
Subject	ECTS	Subject	ECTS
Automation II	6	Control Engineering II	6
Power Electronics	6	Digital Electronics	6
Analog Electronics	6	Electric Motors and Actuators	6
Basic Electric Technology	6	Option 1	6
Control Engineering I	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
Project Management	6	Mechanical Engineering of Fluids	6
Technology of Fabrication and Machines	6	Environmentally Friendly Technology	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
Aalborg Universitet	DENMARK
Ingeniørhøjskolen i Aarhus	DENMARK
Ingeniørhøjskolen i Kobenhavn	DENMARK
Vitus Bering	DENMARK
University of Maribor	SLOVENIA
École d'Ingenieurs du Pas de Calais	FRANCE
Université Pierre et Marie Curie – Paris VI	FRANCE
Supélec	FRANCE
Université Evry Val d'Essonne	FRANCE
Université Henri Poincaré	FRANCE
Technische Universiteit Delft	NETHERLANDS
Technische Universiteit Eindhoven	NETHERLANDS
Institute of Technology, Tralee	IRELAND
Reykjavik University	ICELAND
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 Pavia	ITALY
Università degli Studi di Perugia	ITALY
Università degli Studi di Salerno	ITALY

Kaunas University of Technology	LITHUANIA
Vilnius Gediminas Technical University	LITHUANIA
Akademia Polonijna w Czestochowie	POLAND
Politechnika Wroclawska	POLAND
Instituto Politécnico Coimbra	PORTUGAL
Instituto Politécnico de Bragança	PORTUGAL
Instituto Politécnico de Setúbal	PORTUGAL
Instituto Politécnico Porto	PORTUGAL
Instituto Superior Técnico Lisboa	PORTUGAL
Instituto Politécnico de Leiria	PORTUGAL
Universidade de Aveiro	PORTUGAL
Universidade de Coimbra	PORTUGAL
Universidade de Evora	PORTUGAL
Universidade de Tras os Montes e Alto Douro	PORTUGAL
Universidade do Algarve	PORTUGAL
Coventry University	UNITED KINGDOM

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
Universidade 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

University	Country
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 Americas-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:

SUBJECT DESCRIPTION TABLE	
Subject Title	
Subject Area	
Type	Basic Core; Compulsory; Optional
Number of ECTS Credits	6
Scheduling	First Semester; Second Semester; .....
Prerequisites	*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*

METHOD OF ASSESSMENT

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				
1. Theoretical Studies							
2. Practicals							
3. Assessments							
TOTAL							
C = Class (whole-group session) S = Seminar (part-group session) T = Tutorial (individual session)							
Description of the teaching and learning activities							

CONTENTS

DESCRIPTION OF SKILLS

SUBJECT DESCRIPTION TABLE	
Subject Title	Linear Algebra and Geometry
Subject Area	Mathematics
Module	Basic Core

Type	Basic 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.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (2.5 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical	18	8.5	0.2	30	2.27	37.83	All
Practicals		27		51	3.13	52.17	All
Assessments	6	0	0.2	9	0.60	10	All
TOTAL	24	35.5	0.5	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.

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

Seminar sessions (S) comprise activities carried out in medium-sized groups of up to 25. Practicals involving the use of computer programs will be held to the extent that the University's resources permit this.

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

CONTENTS

I. Systems of linear equations. Matrices and determinants.

II. Vector spaces.

III. Diagonalization.

IV. Affine and Euclidean geometry.

V. Quadratics and conics.

DESCRIPTION OF SKILLS

(a) Ability to resolve the mathematical problems that may arise in engineering.

(b) Ability to apply a knowledge of linear algebra and geometry.

(c) Ability to think critically.

(d) Capacity to communicate in writing in Spanish in a correct and mathematically rigorous fashion.

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

METHOD OF ASSESSMENT

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

- In-class written tests.
- Project work, essays and similar.
- Oral presentations.
- Other complementary activities.

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				
1. Theoretical Studies	9	8.5	0.25	30	1.91	31.83	All
2. Practicals	9	27	0.25	60	3.85	64.17	All
3. Assessment	5.5		0.5		0.24	4	All
TOTAL	23.5	35.5	1	90	6	100	

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

Class sessions (C) comprise activities carried out in large groups of up to 70 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

Transferrable:

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	Mathematical Methods in Engineering
Subject Area	Mathematics
Module	Basic Core
Type	Basic Core
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually or in group work, undertaken where appropriate during attendance at a timetabled session, will be achieved by assigning appropriate weightings to the following activities:

- In-class written tests.
- Project work, essays and similar.
- Oral presentations.
- Other complementary activities.

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				
1. Theoretical Studies	12	8.5	0.25	30	2.03	33.83	All
2. Practicals	6	27	0.25	60	3.73	62.17	All
3. Assessment	5.5		0.5		0.24	4	All
TOTAL	23.5	35.5	1	90	6	100	

Student work with teachers will in all cases require attendance at timetabled sessions.

Class sessions (C) comprise activities carried out in large groups of up to 60 students.

Seminar sessions (S) comprise activities carried out in "medium" groups of up to 20 students.

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

CONTENTS

- First-order differential equations.
- Higher-order differential equations and systems of first-order equations.
- Introduction to partial differential equations.
- Plane differential curves.
- Torsion of differential curves.
- Surfaces in Euclidean space. Curves distinguished on surfaces.

DESCRIPTION OF SKILLS
Transferrable: 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 geometry; differential and partial differential equations.

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

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, individually or in group work, whether or not undertaken during a timetabled session, 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 for each 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	0.25	51	3.13	52.17	a, b, c
Assessment	5	0.5	0.5	9	0.60	10	All
TOTAL	23	36	1	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.

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

Seminar sessions (S) comprise activities carried out in medium-sized groups of up to 25 students. As a

function of the resources available to the University practical sessions with computer packages will be held.

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

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

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:

- Work periodically submitted for assessment, whether done individually or in groups
- Reports on activities
- Written examination with theoretical and practical sections

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				
1. Theoretical Studies	26		1	40	2.68	44.7	a,c,d
2. Practicals	9	20	1	28	2.32	38.7	a,b,c,d,e
3. Assessment	4		1	20	1	16.6	All
TOTAL	39	20	3	88	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder, especially tutorials, may 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 theoretical and practical sessions in the classroom the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In S-type sessions held in the classroom, the instructor will guide the students in the application of theoretical concepts and results for resolving problems, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

The remaining S-type sessions will be held in the laboratory. In these sessions the instructor will introduce students to a knowledge of safely and behaviour standards and the use of various instruments.

CONTENTS

I. Magnitudes, units and dimensions
II. Statics: Forces and moments. Bodies in equilibrium. Centre of gravity. Moment of inertia.
III. Particle kinematics and dynamics.
IV. Dynamics of systems and solids: energy-based methods. Methods based on the quantity of movement. Rotary movement.
V. Fields and Waves.

DESCRIPTION OF SKILLS

a. Understanding and mastery of the basic concepts of the general laws of mechanics and thermodynamics and their application to resolving problems specific to engineering.
b. Ability to set up equipment and carry out practical laboratory experiments.
c. Ability to perform and interpret calculations for the experiments and problems undertaken.
d. Ability to learn independently.
e. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Heat, Electricity and Magnetism
Subject Area	Physics
Module	Basic Core
Type	Basic Core
Number of ECTS Credits	6
Scheduling	Second Semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, whether individually and/or in groups, will be achieved by assigning appropriate weightings to the following activities:
- Work periodically submitted for assessment, whether done individually or in groups.
- Reports on activities
- Written examinations with theoretical questions and practical exercises

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				
1. Theoretical Studies	30		1	40	2.84	47.3	a,b,d
2. Practicals	10	15	1	28	2.16	36.0	a,b,c,d,e
3. Assessment	4		1	20	1	16.7	All

TOTAL	44	15	3	88	6	100	

About 95% of student work with instructors will involve attendance at timetabled sessions. The remainder, especially tutorials, may 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 theoretical and practical sessions in the classroom the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In S-type sessions held in the classroom, the instructor will guide the students in the application of theoretical concepts and results for resolving problems, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

The remaining S-type sessions will be held in the laboratory. In these sessions the instructor will introduce students to a knowledge of safely and behaviour standards and the use of various instruments.

CONTENTS

I. Thermodynamics: Heat. The first law of thermodynamics. The second law of thermodynamics.
II. Electricity and Magnetism: Gauss' Law. Ampère's Law. Faraday's Law. Maxwell'.

DESCRIPTION OF SKILLS

a. Understanding and mastery of the basic concepts of the general laws of mechanics and thermodynamics and their application to resolving problems specific to engineering.
b. Understanding and mastery of the basic concepts of the general laws of electricity and magnetism and their application to resolving problems specific to engineering.
c. Ability to perform and interpret calculations on the basis of the experiments undertaken.
d. Ability to learn independently.
e. Ability to work in a group.

SUBJECT DESCRIPTION TABLE	
Subject Title	Chemistry
Subject Area	Chemistry
Module	Basic Core
Type	Basic Core
Number of ECTS Credits	6
Scheduling	First Semester
Prerequisites	It is recommended that students should have taken chemistry as a subject during the year prior to their entry into the University

METHOD OF ASSESSMENT

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

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

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)		ECTS	%	Related Skills
	With Instructor	Without			

	C	S	T	Instructor			
1. Theoretical Studies	26	5	0.5	35	2.66	44.33	a,c,d
2. Practicals	9	15	0.5	25	1.98	33.00	a,b,c,d,e
3. Assessment	4	1	1	28	1.36	22.67	All
TOTAL	39	21	2	88	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, 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.
Other types of work will be set for students to present individually.
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 chemistry laboratories and in the use of instruments to determine the physical properties of materials. 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.

CONTENTS

Theory Classes

Topic 1: Fundamental concepts
Topic 2: Aggregation states of matter and solutions
Topic 3: Thermodynamics and chemical kinetics
Topic 4: Chemical equilibrium
Topic 5: Electro-chemistry
Topic 6: Structure and reactivity of organic compounds
Topic 7: Hydrocarbons
Topic 8: Organic functions: oxygenated and nitrogenized compounds
Topic 9: Polymers

Practicals

Practical 1. Standards for use of equipment and safety measures. Employment of apparatus and handling of reagents and chemicals.
Practical 2. Preparation of solutions
Practical 3. Stoichiometry of a compound. Law of the conservation of matter.
Practical 4. Determination of the calcium carbonate in limestone (gravimetry)
Practical 5. Chemical kinetics. Study of the factors affecting the speed of reactions.
Practical 6. Acid-base volumetry.
Practical 7. Electrolysis. Experimental determination of Faraday's constant
Practical 8. Organic reactions
Practical 9. Polymerization

DESCRIPTION OF SKILLS

a. Ability to understand and apply the principles of basic knowledge of general chemistry, organic and inorganic chemistry and their uses in engineering.
b. Ability to set up equipment and carry out practical laboratory experiments.
c. Ability to perform and interpret calculations for the experiments undertaken.
d. Ability to learn independently.
a. Ability to work in a group.

SUBJECT DESCRIPTION TABLE	
Subject Title	Graphic Design I
Subject Area	Graphic Design
Module	Basic Core

Type	Basic Core
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	None

METHOD OF ASSESSMENT

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

- Work to be submitted for continuous assessment.
- Complementary activities.
- Theoretical and practical examinations.

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				
1. Theoretical Studies	10	18	0.5	46	3	50.3	All
2. Practicals	6	21	0.5	22	2	32.6	All
3. Assessment	4	1	1	20	1	17.1	All
TOTAL	20	40	2	88	6	100	

All teaching and learning activities of students with instructors require attendance at timetabled hours.
In classroom theoretical sessions the instructor will present the concepts and methodology of the points being covered by means of theoretical explanations and illustrative problems.
In classroom practical sessions the instructor will guide students in theoretical and practical applications of systems for representation and normalization.

CONTENTS

I. Applications for geometrical representation
II. Descriptive geometry I
III. Normalization I
IV. Introduction to computer-aided design

DESCRIPTION OF SKILLS

a. Capacity for spatial vision and knowledge of the techniques for graphical representation, both using the traditional methods of metric and descriptive geometry, and by means of computer-aided design applications.
b. Spatial visualization.
c. Operational graphic capacity.
d. Acquiring theoretical and practical knowledge of normalization and the conventionalisms used and applied by engineering professionals in technical drawing.
e. Mastery of the reading needed for industrial graphical representations, such as to allow reconstruction in space of objects shown in projections.
f. Industrial-style sketching in conformity with the format stipulated in standards for representation.

SUBJECT DESCRIPTION TABLE

Subject Title	Computing
Subject Area	Computing

Module	Basic Core
Type	Basic Core
Number of ECTS Credits	6
Scheduling	Second Semester
Prerequisites	None

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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	20		1,25	22	1,73	28,8	All
2. Practicals		35	1.25	44	3.21	53.5	All
3. Assessment	2.5	2.5	0.5	21	1.06	17.7	All
TOTAL	22.5	37.5	3	87	6	100	

Approximately 95% of student work with instructors will involve attendance at timetabled hours. The remainder will be undertaken 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 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 and programming work will be set which the students will complete, thus acquiring skill in the use of the tools necessary for resolving problems and writing programs.

CONTENTS

I. Basic components of hardware.
II. Operating systems: start-up.
III. Flow-charts for information management.
IV. Data structures.
V. Databases.
VI. Basic algorithms applicable to engineering.
VII. Practicals: programming in a high-level language.

DESCRIPTION OF SKILLS

a. Basic knowledge of the use of computers.
b. Basic knowledge of operating systems, databases and software for resolving problems specific to engineering.
c. Basic knowledge of programming.
d. Ability to work in a group.
e. Ability of students to express themselves correctly when using terms from computing.
f. 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.
g. 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.

h. Development by students of the 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	Basic Core
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, individually or in group work, whether or not completed during attendance at a timetabled session, will be achieved by assigning an appropriate weighting to the following activities:

- In-class tests.
- Work submitted at intervals, either individual or group tasks.
- Complementary activities.

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				
1. Theoretical Studies	20	2	0.2	22	1.77	29.46	a, b, c
2. Practicals	10	20	0.3	40	2.81	46.86	a, b, c, d, e
3. Assessment	4	2.5	1	28	1.42	23.67	All
TOTAL	34	24.5	1.5	90	6	100	

Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be by means of the use of new information and communication 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 introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom practical sessions (whether whole-group or seminar-type), the instructor will guide the students in the application of theoretical concepts and results to the solution of problems, at all times encouraging critical thinking. Exercises will be set for students to complete, thus acquiring skill in the use of the tools necessary for resolving 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 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	Thermodynamics
Subject Area	Physics
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth Semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired will be achieved by consideration and weighting of the practical activities carried out, whether individually or in a group (up to a maximum of 20% of the total marks), together with a final test on the theoretical and practical material covered.

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	30		1	60	3.64	60.7	a, b, c, d, e, g
II. Practicals	8	16	0.5	30	2.18	36.3	a, b, d, e, f ,g
I. Assessment	4		0.5		0.18	3.0	All
TOTAL	42	16	2	90	6	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.

In classroom theoretical sessions, the instructor will present the concepts, results and methods of the field, 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 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.

In practical sessions in the laboratory, the instructor will guide the students to a knowledge of safety and behaviour standards, of the use of the basic equipment of a laboratory and the employment of instruments.

Students will perform simple experiments that complement and exemplify the materials covered in classes, for which they will apply the tools for the solving of problems that they have acquired.

CONTENTS

I. Fundamental concepts of thermodynamics
II. Thermodynamic properties of pure substances
III. First law of thermodynamics
IV. Second law of thermodynamics. Entropy.
V. Analysis of flow processes.

VI. Thermodynamic cycles of gas.
VII. Thermodynamic cycles of gas turbines and propulsion.
VIII. Transmission of heat. Fundamental principles.
IX. Transmission of heat through conduction.
X. Transmission of heat through convection
XI. Transmission of heat through radiation

DESCRIPTION OF SKILLS

a. Knowledge of applied thermodynamics and the transmission of heat.
b. Knowledge of basic principles and their application to solving problems in engineering.
c. Drawing up and presenting arguments and solving problems in applied thermodynamics in a reasoned and professional fashion
d. Ability to gather and interpret relevant data so as to express opinions including reflections on 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 for team work.
g. Ability to undertake further study of applied thermodynamics with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Mechanical Engineering of Fluids
Subject Area	Physics
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Eighth Semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in a group, whether or not completed during a timetabled session, will be carried out continuously throughout the semester, with the following weightings and activities:
- 10% In-class tests.
- 10% Work to be submitted.
- 80% Examination.

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	32		1	65	3.92	65.33	a,c,d,e,f,g,h
I. Practicals	14	7	0.5	25	1.86	31.00	a,b,c,d,e,f,g,h
I. Assessment	4	1	0.5		0.22	3.67	All
TOTAL	50	8	2	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.
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.
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 sessions of type S, 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 students to complete, thus acquiring skill in the use of the tools necessary for solving problems.
In practical sessions in the laboratory, the instructor will guide the students in the use of basic experimental techniques to develop in them the ability to assemble hydraulic circuits and handle apparatus, so that students can produce useful information about a phenomenon from experimental results as well as present that information in an appropriate fashion (use of non-dimensional parameters, graphs and so forth.).
Students will carry out simple experiments to complement and exemplify the material covered in classes, for which they will apply the tools for the resolution of problems that they have acquired.

CONTENTS

I. Fundamentals of fluid mechanics.
II. Statics of fluids.
III. Kinematics of fluids.
IV. Dynamics of fluids.
V. Applications of Bernoulli's principle
VI. Analysis of fluid mechanics.
VII. Boundary layer.
VIII. Loss of load in pipes.
IX. Engineering of pipework systems.
X. Ram strike.
XI. Channels.
XII. Instruments and measurement of fluids.
XIII. Hydro-electric power stations.
XIV. Water turbines. Output and trials.
XV. Regulation of turbomachinery.
XVI. Cavitation in turbomachinery.
XVII. Centrifugal, axial and volumetric hydraulic pumps.

DESCRIPTION OF SKILLS

a. Knowledge of the basic principles of fluid mechanics and their application to the solving of problems in the field of engineering. Calculations for pipes, channels and systems of fluids.
b. Ability to set up equipment and carry out practical laboratory experiments.
c. An understanding and awareness of the field of fluid mechanics based on advanced textbooks, including aspects that imply knowledge derived from the cutting edge of the industrial sector.
d. Preparing arguments and making a case for them and solving problems in fluid mechanics by applying the knowledge acquired in a reasoned and professional manner.
e. Interpretation of sets of relevant data so as to express opinions including thoughts about appropriate topics of a scientific nature.
f. Ability to work individually and in a team.
g. Ability to analyse and solve problems.
h. Ability to present work in a clear and attractive way.
i. Ability to transmit information, ideas, problems and solutions, either to a specialist or to a non-specialist audience.
j. Ability to continue study of mechanical engineering of fluids with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Environmentally Friendly Technology
Subject Area	Chemical engineering
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Eighth semester

Prerequisites	None

METHOD OF ASSESSMENT

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

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

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				
1. Theoretical Studies	26		0.5	32	2.34	39.00	a, b, d, f
2. Practicals		22	1	21	1.76	29.33	a, b, d, e, f
3. Assessment	6	10	1.5	30	1.90	31.67	All
TOTAL	32	32	3	83	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, 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 computer laboratory, the instructor will guide the students in the use of simulation programs for calculating installations. The students will complete exercises to complement and exemplify the material covered in class sessions. In this work students will apply the tools for solving problems that they have acquired.

Students will give presentations on the topics assigned to them by the instructor, which will relate to their visits to industrial installations linked to the environment.

CONTENTS

I. Problems of water and air pollution and contamination by residues: legal aspects, sources, indicator parameters.
II. Treatment of waste water
III. Control of air pollution
IV. Residues. Residues of electrical and electronic equipment
V. Environmental management in industry and sustainability

DESCRIPTION OF SKILLS

a. Basic knowledge and application of environmental technologies and sustainability
b. Critical reasoning
c. Decision making
d. Sensitivity to environmental matters
e. Creativity and innovation

SUBJECT DESCRIPTION TABLE	
Subject Title	Resistance of Materials
Subject Area	Resistance of materials
Module	Common Core for Industrial Subjects
Type	Compulsory

Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	Physics, Mathematics

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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	30		1.5	31	2.5	41.67	All
Practicals		30	1	31	2.48	41.33	All
Assessment	9	3	0.5	13	1.02	17	All
TOTAL	39	33	3	75	6	100	

Approximately 95% of student work with instructors will involve attendance at timetabled hours. The remainder will be undertaken 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 classroom and laboratory 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 which the students will complete, thus acquiring skill in the use of the tools necessary for resolving problems.

CONTENTS

I. Basic concepts of tension and deformation.
II. Elasticity of parts: bar model, laws of stress and strain.
III. Axial stresses and strains: tensions and deformations.
IV. Tensions produced by flexion.
V. Tensions produced by shearing.
VI. Tensions produced by torsion.
VII. Tensions produced by a combination of stresses and strains.

DESCRIPTION OF SKILLS

a. Knowledge and use of the principles of the resistance of materials.
b. Capacity to analyse and solve problems.
c. Capacity for independent learning.
d. Capacity to interpret results.

SUBJECT DESCRIPTION TABLE

Subject Title	Materials Technology
Subject Area	Mechanical and Fabrication Engineering
Module	Common Core for Industrial Subjects
Type	Compulsory

Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	Chemistry

METHOD OF ASSESSMENT

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

- Examinations.
- Pieces of work periodically submitted for marking, whether done individually or in groups.
- Reports on laboratory work.

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				
Theoretical Studies	30		0.5	40	2.82	47	a,b,c,d,f,h
Practicals		24	1	15	1.6	26.67	All
Assessment	4	2	0.5	33	1.58	26.33	All
TOTAL	34	26	2	88	6	100	

Criteria:
Students will spend at least 5% of their working time without an instructor on preparation for classes, reading material from a list supplied in advance by the instructor.
Approximately 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. 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 illustration with examples.
- In classroom practical sessions, the instructor will assist the students in applying theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, hence providing them with skills in the use of the tools necessary for resolving problems.
- In practicals in the laboratory, the instructor will guide students to a knowledge of the standards for safety and behaviour in the use of the equipment and basic instruments of a materials laboratory. Students will perform simple experiments that will complement and exemplify the points covered in classes.

CONTENTS

I. **Fundamentals of Materials Science.** Crystalline structure. Diffusion processes. Mechanical properties. Phase transformations.

II. **Materials and Treatments.** Ferrous alloys. Non-ferrous alloys. Ceramics. Polymers. Compound materials. Physical properties of materials.

III. **Electrical and Magnetic Properties of Materials.**

IV. **Behaviour of Materials in Processes of Plastic Deformation, Moulding and Welding.**

DESCRIPTION OF SKILLS

a. Acquiring a knowledge of the fundamentals of the science, technology and chemistry of materials.

b. Understanding the relationship between microstructure, synthesis or processing and the properties of materials.

c. Acquiring knowledge and capacities for the application of materials engineering.

d. Basic knowledge of systems of production and manufacturing.

e. Effective development of oral and written communication.

f. Capacity for independent learning.

g. Ability to work in a team.

h. Ability to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Technology of Fabrication and Machines
Subject Area	Mechanical and Fabrication Engineering
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Seventh semester
Prerequisites	None

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and skills worked on individually or in groups, whether with or without the instructor will be assessed.

Split:

- 40% of the final mark will be based on the grades obtained during tests.
- 30% will be based on work done by students during the course, either individually or in groups.
- The remaining 30% will be based on practicals performed by students and the related reports on them.

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				
1. Theoretical Studies	30		0.5	40	2.82	47	a,b,c,d,h
2. Practicals		24	1	15	1.6	26.67	b,c,d,e,f,g
3. Assessment	4	1.5	1	33	1.58	26.33	All
TOTAL	34	25.5	2.5	88	6	100	

Criteria:

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.

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.

- 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 sessions of type S, 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 students to complete, thus acquiring skill in the use of the tools necessary for solving problems.
- In practical sessions in the workshop and laboratory, the instructor will guide the students to an awareness of standards for safety and behaviour, in the use of the equipment and basic

instrumentation of a shaping and welding workshop. Students will carry out simple experiments to complement and exemplify the material covered in classes.

CONTENTS

I. **Introduction to Fabrication Engineering.** The factory environment.

II. **Dimensional Tolerances and Fit.** Dimensional tolerances. Shape and position tolerances. Fit.

III. **Dimensional Metrology.** Theory of errors and calibration. Measurement of linear magnitudes. Measurement of shape and surface finish.

IV. **Quality in Manufacturing.** Planning for quality. Quality in fabrication. Methods of inspection and verification.

V. **Machining Processes.** Analysis of machining processes. Financial aspects of machining. Elements of machine tools.

VI. **Basic Concepts of Machines and Mechanisms.** Elementary mechanisms. Determination of loads. Stress, strain and deformation.

DESCRIPTION OF SKILLS

a. Ability to understand basic knowledge about systems of production and fabrication.

b. Ability to understand and apply the principles of metrology and quality control in manufacturing.

c. Ability to understand and apply knowledge of fabrication systems and processes.

d. Ability to understand and apply principles of the theory of machines and mechanisms.

e. Effective development of oral and written communication.

f. Capacity for independent learning.

g. Ability to work in a team.

h. Ability to analyse and solve problems.

SUBJECT DESCRIPTION TABLE

Subject Title	Principles of Electric Machines and Circuits
Subject Area	Electricity
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	

METHOD OF ASSESSMENT

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

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

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				
Theoretical Studies	30		1	60	3.64	60.67	a; b; c; e
Practicals	10	15	0.5	30	2.22	37	b; c; d;
Assessment	3		0.5		0.14	2.33	
TOTAL	43	15	2	90	6	100	

In Theoretical Studies, students' personal work (carried out without the instructor) will consist primarily of the advance preparation of the material that will be covered in classes, on lines indicated by the teaching staff and of revising and studying this material.

Practicals will include working on problems in the application of the theoretical concepts in the subject, activities simulating circuits by means of computers and carrying out the assembly of circuits and electric machines in the workshop. Students' personal work will be directed principally towards the completing of the problems set and to a lesser degree towards drawing up reports on the practical work of simulation and in the workshop.

CONTENTS

I. Basic concepts and methods for analysing circuits.
II. Circuits with a stationary sinusoidal pattern.
III. Simple circuits with a transitory pattern.
IV. Computerized circuit simulation.
V. Magnetic circuits and electromechanical energy converters.
VI. General features common to electric machines.
VII. Classification, characteristics and principal applications of electric machines.

DESCRIPTION OF SKILLS

a. Knowledge of the basic principles, methods for analysing and fundamental theorems of electric circuits in general.
b. Ability to understand and perform calculations for alternating current circuits and determine power, using a symbolic method.
c. Ability to understand and perform calculations for simple transitory circuits.
d. Ability to use one or more tools for computer simulation of circuits, whether with a permanent or transitory pattern, both direct and alternating current, and compare results with those obtained analytically.
e. Awareness of the basic principles of the functioning, component parts and classification of electric machines.
f. Knowledge of the principal industrial applications of the various types of electric machine.
g. Capacity for independent learning.
h. Ability to work in a group.

SUBJECT DESCRIPTION TABLE	
Subject Title	Technology and Fundamentals of Electronics
Subject Area	Electronics
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6

Scheduling	Fourth semester
Prerequisites	Knowledge of electricity and magnetism

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired will be achieved by assigning an appropriate weighting to the following activities:

- In-class tests.
- Work submitted at intervals.
- Complementary activities.

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				
Theoretical Studies	43		0.5	40	3.34	55.67	a, b, c, d, e, f, h
Practicals	3	25	1	16	1.8	30	a, f, g, h, i, j, k, l
Assessment	2	1	0.5	18	0.86	14.33	All
TOTAL	48	26	2	74	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on study and preparation of the materials set by the tutor for each theory or practical session.
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.

- In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations with visual aids, exercises and illustrative examples.
- In classroom practical sessions, the instructor will guide the students in the application of concepts and working methods such as to encourage active participation by students and critical thinking. In solving practical cases, they will be able to make use of various resources that will aid them in understanding the results. Such resources will be used in other subjects over the whole of the degree programme. The intention is for students to be motivated and make active efforts to develop so that they will gain an ability to learn how to learn and how to do, seeking solutions and being able to deduce principles for thinking through real situations.
- The instructor will guide students in their independent work, and in the employment and description of working methods, together with the use of all types of laboratory tools currently utilized in electronics and in modelling electronic components. Real and/or simulated experiments will be performed to complement and permit an understanding of the material covered in theoretical sessions, as also the guidelines for work that will be used in the course of the subject.
- The completion of a final mini-project will allow students to gain enhanced working relationships with their fellow-students, together with an ability to develop capacities for individual and group work, carrying out tasks involving the setting of objectives, the finding of documentation, the performing of analyses, the assignment of work, and its development and final achievement.

CONTENTS

I. Materials and passive components.
II. Semiconductors, assemblies and technologies.
III. Integrated circuits.
IV. Optoelectronics.
V. Basic circuits, design, manufacturing and checking techniques.
VI. Documentation methods and interpretation of data and characteristics.

DESCRIPTION OF SKILLS

a. Knowledge of the fundamentals of electronics.
b. Knowledge of the technology applied to electronics.
c. Ability to take decisions and solve problems through critical thinking.
d. Learning independently new information and techniques permitting the understanding of new components, circuits and electronic systems.

e. Gaining an acquaintance with the handling and selection of technical documents for electronic components
f. Awareness of the fundamentals and basic techniques for developing and manufacturing electronic circuits.
g. Use of computer resources to seek out bibliographical material or information relating to electronics.
h. Ability to carry out measurements and calculations and handle specifications, regulations and standards.
i. Skill in the use of computer tools in electronics.
j. Ability to work in a team, taking on roles and responsibilities, while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.
k. Capacity to organize and plan with a focus on quality.
l. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.

SUBJECT DESCRIPTION TABLE	
Subject Title	Automation I
Subject Area	Automation
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and competences exercised 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 technological mechanisms 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, c, e
Practicals		27.0	1.0	23.0	2.04	34.00	d, e, f, g, h, i, j, k
Assessment	4.0	2.0	1.0	24.0	1.24	20.67	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 industrial automation. Automation pyramid
II. Field instrumentation. Sensors and actuators and their interaction with control equipment.
III. Industrial controllers. Programmable logic controllers, distributed control systems, industrial uses of personal computers ...
IV. Programming of industrial controllers.
V. Industrial robotics.

DESCRIPTION OF SKILLS

a. Knowledge of the fundamentals of automatic devices and control methods.
b. Knowledge of the principles and applications of robotic systems.
c. Applied knowledge of industrial computing.
d. Ability to design systems for control and industrial automation.
e. Ability to understand and apply the principles of basic knowledge of automation.
f. Ability to set up equipment and carry out basic experiments in the laboratory.
g. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of control engineering.
h. Ability to handle environments based on new information and communication technologies (NICTs) and the associated emergent technologies.
i. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form.
j. 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.
k. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Project Management
Subject Area	Projects
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Seventh 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	20	5	0.5	35	2.42	40.33	a, c, e
Practicals	10	15	0.5	35	2.42	40.33	All
Assessment	3	5	1	20	1.16	19.33	All
TOTAL	33	25	2	90	6	100	

Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The rest will be done 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 introduce the concepts, results and methods of the subject, by means of theoretical explanations and examples as illustrations.

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. Business and project organization.
II. Projects and project offices.
III. Project management in the life-cycle of a project.
IV. Areas of knowledge in project management
V. Methodological aspects of project management

DESCRIPTION OF SKILLS

a. Knowledge and capacities needed to organize and manage projects. Awareness of the organizational structure and functions of a project office.
b. Applied knowledge of business organization.
c. Students should be able to apply their knowledge to their work or vocation in a professional manner and have the competences that are normally demonstrated by formulating and arguing in favour of viewpoints and solving problems within their field of study.
d. Students should have the capacity to gather and interpret relevant data (normally from within their field of study) so as to express opinions including evidence of reflection on appropriate topics of a social, scientific or ethical nature.
e. Students should be able to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
f. Students should have developed the learning abilities necessary to undertake further studies

with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Basic Electrical Technology
Subject Area	Electricity
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	

METHOD OF ASSESSMENT

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

• **Written examinations.** These will assess primarily mastery of the basic knowledge of the subject, both theory and problem-solving.

• **Reports on laboratory work.** These will be used to evaluate the skills acquired by students in the practical application of their knowledge. All practical work set must be completed.

• **Work submitted, whether done individually or in groups.** These will be pieces related to activities in the laboratory or in seminars, and intended to demonstrate the level of skills and know-how attained.

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	33		1	33	2.68	44.67	a, b, d, g, h
II. Practicals		22	0.5	22	1.78	29.67	a, c, e, f, g, h
II. Assessment	3		0.5	35	1.54	25.66	All
TOTAL	36	22	2	90	6	100	

In classroom theoretical studies sessions the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples. The instructor will guide the students in solving 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 the resolution of problems. Personal work done by students (without the instructor) will consist basically of preparation of materials that will be covered in class and completion of exercises along the guidelines given by the instructors.

In practicals the instructor will direct the students towards a knowledge of safety and behaviour standards in the use of instruments for determining electric magnitudes, simple experiments will be carried out and problems will be solved so as to complement and exemplify the material presented during classes. Personal work by students will concentrate primarily on the solving of the problems set and the drawing up of reports on the experiments performed.

Personal work of students for assessment will consist of studying the points taught and completing the exercises set.

CONTENTS

I. Multiphase current

II. Balanced and unbalanced three-phase systems.

III. Measurement of power in three-phase systems.

IV. Single-phase transformers.
V. Measurement and protection transformers
VI. Three-phase transformers.
VII. Transformer sub-stations
I. DESCRIPTION OF SKILLS
a. Applied knowledge of electrical technology b. Ability to learn independently. c. Capacity for team work. d. Capacity for analysing and solving problems. e. Ability to set up equipment and perform practical experiments in the laboratory. f. Ability to perform and interpret calculations for the experiments undertaken. g. Effective development of spoken and written communication. h. Decision-taking.

SUBJECT DESCRIPTION TABLE	
Subject Title	Electronic Instrumentation
Subject Area	Electronics
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired will be achieved by assigning an appropriate weighting to the following activities:

- In-class tests.
- Work submitted at intervals.
- Complementary activities.

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				
Theoretical Studies	30			40	2.8	46.67	a, b, c, f, h, i
Practicals		30	1	32	2.52	42	All
Assessment	2		1	14	0.68	11.33	All
TOTAL	32	30	2	86	6	100	

The subject will be of a fundamentally practical nature. A number of practicals will be held, initially whole-group, later small-group and individual.

In the first phase students will be guided in the handling of laboratory instruments by working on various assemblies. An individual or group assessment of the use of instrumentation will be undertaken.

In the second phase students will demonstrate the skills they have acquired during the first phase. They will learn more independently and their capacity to take decisions when facing various practical requirements will be encouraged.

CONTENTS
I. Measurement and error. II. Transducers III. Networks, attenuators and filters. IV. Bridges and basic measuring instruments. V. Principles of signal conditioning and treatment. VI. Instrumentation and measurements in the electronics laboratory.
DESCRIPTION OF SKILLS
a. Applied knowledge of electronic laboratory instruments. b. Ability to carry out measurements and calculations and handle specifications, regulations and standards. c. Ability to select appropriate instruments for use in each experiment or measurement. d. Capacity to handle instruments with professional skill and competence e. Ability to detect problems with instruments and to solve them. f. Ability to use the software needed for working with instrumentation systems. g. Capacity for organization and planning with an emphasis on quality. h. Ability to learn independently. i. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.

SUBJECT DESCRIPTION TABLE	
Subject Title	Analog Electronics
Subject Area	Electronics
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	Principles of Electric Machines and Circuits; Technology and Fundamentals of Electronics.

METHOD OF ASSESSMENT

Assessment of student work and of acquisition of skills will be achieved by assigning the following weightings:
80% Marks from the various tests that will be held.
15% Evaluation of individual and/or small-group work in practical activities and seminars.
5% Evaluation of other individual activities.

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				
Theoretical Studies	30		0.5	45	3.02	50.33	a, b, c, f, g
Practicals		24	0.5	17	1.66	27.67	a, b, c, d, e ,f, h.
Assessment	3	1	1	28	1.32	22	All
TOTAL	33	25	2	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on study and preparation of the materials set by the tutor for each theory or practical session.

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.

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

In classroom practical sessions, the instructor will guide the students in the application of concepts and problem-solving techniques, always encouraging analysis and critical thinking. Exercises will be set for students to complete, so that they will acquire skills in the handling of the tools needed for the resolution of problems in the subject.

In practical sessions in the laboratory, the instructor will guide the students in independent work and assist them in gaining a knowledge of safety and behaviour standards. The instructor will also help students to use the instruments and tools of laboratories specific to the subject and the tools and techniques for the design of electronic circuits. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions and the subject's working methods.

CONTENTS

I. Analog systems.
II. Circuits with diodes.
III. Amplification.
IV. Feed-back.
V. Effects of frequency.
VI. Analog integrated circuits.
VII. Signal generators and multivibrators.
VIII. Applications and design of electronic circuits.

DESCRIPTION OF SKILLS

a. Knowledge of the fundamentals and applications of analog electronics.
b. Ability to design analog electronic systems.
c. Ability to take decisions, and to analyse and solve problems with initiative, creativity and critical thinking.
d. Ability to carry out measurements and calculations and handle specifications, regulations and standards.
e. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.
f. Capacity for organization and planning with an emphasis on quality.
g. Capacity for independent learning.
h. Ability to work in a team, taking on roles and responsibilities, while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.

SUBJECT DESCRIPTION TABLE	
Subject Title	Digital Electronics
Subject Area	Electronics
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	Completion of the course in Technology and Fundamentals of Electronics

METHOD OF ASSESSMENT

Assessment of student work and of acquisition of skills will be achieved by assigning the following weightings:
80% Marks from the various tests that will be held.
15% Evaluation of individual and/or small-group work in practical activities and seminars.

5% Evaluation of other individual activities.

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				
Theoretical Studies	30		0.5	45	3.02	50.3	a, b, c, f, g
Practicals		24	0.5	15	1.58	26.3	a, b, c, d, e ,f, h
Assessment	3	1	1	30	1.40	23.4	All
TOTAL	33	25	2	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on study and preparation of the materials set by the tutor for each theory or practical session.

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

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

In classroom practical sessions, the instructor will guide the students in the application of concepts and problem-solving techniques, at all times encouraging analysis and critical thinking. Exercises will be set for students to complete, so that they will acquire skills in the handling of the tools needed for the resolution of problems in the subject.

In practical sessions in the laboratory, the instructor will guide the students in independent work and assist them in gaining a knowledge of safety and behaviour standards. The instructor will also help students to use the instruments and tools of laboratories specific to the subject and the tools and techniques for the design of electronic circuits. Real or simulated experiments will be performed, complementing and exemplifying the points covered in classroom sessions and the subject's working methods.

CONTENTS

I. Digital systems.
II. Combinatorial logic.
III. Sequential logic.
IV. Counters, clocks, registers and memories.
V. System interfaces.
VI. Programmable logic circuits.
VII. Microprocessors and microcontrollers.
VIII. Digital electronic design.

DESCRIPTION OF SKILLS

a. Knowledge of the fundamentals and applications of digital electronics and microprocessors.
b. Ability to design digital electronic systems.
c. Ability to take decisions, and to analyse and solve problems with initiative, creativity and critical thinking.
d. Ability to carry out measurements and calculations and handle specifications, regulations and standards.
e. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.
f. Capacity for organization and planning with an emphasis on quality.
g. Capacity for independent learning.
h. Ability to work in a team, taking on roles and responsibilities, while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.

SUBJECT DESCRIPTION TABLE	
Subject Title	Power Electronics
Subject Area	Electronics
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth Semester
Prerequisites	Basic knowledge of electronics and circuit theory.

METHOD OF ASSESSMENT

Assessment of student work and of acquisition of skills will be achieved by assigning the following weightings:
Marks from the various tests that will be held (80% of the final grade).
Evaluation of individual and/or small-group work in practical activities and seminars. In order to pass the subject, it will be necessary to attain a passing mark for laboratory work (15% of the final grade).
Evaluation of other individual activities (5% of the final grade).

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				
Theoretical Studies	37		0.5	55	3.7	61.6	a, b, d, e
Practicals	12	7.5	0.25	15	1.39	23.2	a, b, c, d, e, f
Assessment	2		0.75	20	0.91	15.2	All
TOTAL	51	7.5	1.5	90	6	100	

Student work with instructors will in all cases require attendance at scheduled sessions.

Students will follow the indications given by teaching staff with respect to study, reading texts and preparing materials prior to each theory or practical session, so as to undertake this work during the time assigned for working without the instructor.

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

In classroom practical sessions, the instructor will guide the students in the application of concepts and problem-solving techniques, at all times encouraging analysis and critical thinking. Exercises will be set for students to complete, so that they will acquire skills in the handling of the tools needed for the resolution of problems in the subject.

In practical sessions in the laboratory, the instructor will guide the students in independent work and assist them in gaining a knowledge of safety and behaviour standards. The instructor will also help students to use the instruments and tools of laboratories specific to the subject and the tools and techniques for the design of electronic circuits. Real or simulated experiments will be performed, complementing and exemplifying the points covered in classroom sessions and the subject's working methods.

CONTENTS

I. Components and circuits
II. Rectification
III. Alternating current controllers.
IV. Chopper circuits.
V. Inverters. Resonant inverters
VI. Frequency converters

VII. Power supplies and uninterruptable power supplies
VIII. Design of power circuits

DESCRIPTION OF SKILLS

a. Ability to specify, design, simulate and implement circuits, equipment and electronic systems, whether pulsed, power or mixed.
b. Ability to take decisions, and to analyse and solve problems with initiative, creativity and critical thinking.
c. Ability to carry out measurements and calculations and handle specifications, regulations and standards.
d. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.
e. Capacity for organization and planning with an emphasis on quality.
f. Capacity for independent learning.
g. Ability to work in a team, taking on roles and responsibilities, organizing and planning with a view to quality, while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.

SUBJECT DESCRIPTION TABLE

Subject Title	Automation II
Subject Area	Automation
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and competences exercised 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 technological mechanisms 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, d
Practicals		27.0	1.0	23.0	2.04	34.00	c, d, e, f, g, h, i, j
Assessment	4.0	2.0	1.0	24.0	1.24	20.67	
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. Documentation and phases of an automation project.
II. Industrial communications. Field buses.
III. Implementation of regulators in industrial controllers.
IV. Features of plant operations. Supervisory control and data acquisition (SCADA) systems.
V. Standards applicable to industrial automation.

DESCRIPTION OF SKILLS

a. Applied knowledge of industrial computing and communications.
b. Knowledge of automatic regulation and control techniques and their application to industrial automation.
c. Ability to design systems for control and industrial automation.
d. Ability to understand and apply the principles of a basic awareness of automation.
e. Ability to set up equipment and perform practical experiments in the laboratory.
f. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of control engineering.
g. Ability to handle environments based on NICTs and the associated emergent technologies.
h. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form.
i. 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.
j. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Control Engineering I
Subject Area	Automation
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and competences exercised 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 technological mechanisms 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, c, e
Practicals		27.0	1.0	23.0	2.04	34.00	d, e, f, g, h, i, j, k, l
Assessment	4.0	2.0	1.0	24.0	1.24	20.67	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 control systems. II. Modelling and simulation of dynamic continuous systems. III. Analysis of system responses in the domain of time. IV. Analysis of system responses in the domain of frequency. V. Study of systems with feed-back. VI. Design and tuning of regulators.

DESCRIPTION OF SKILLS
a. Knowledge of the fundamentals of control methods. b. Knowledge and ability to model and simulate systems. c. Knowledge of automatic regulation and control techniques. d. Ability to design control systems e. Ability to understand and apply the principles of a basic awareness of control engineering. f. Ability to design and tune control elements. g. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of control engineering. h. Ability to handle environments based on NICTs and the associated emergent technologies. i. Ability to set up equipment and perform practical experiments in the laboratory. j. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form. k. 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 l. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Control Engineering II
Subject Area	Automation
Module	Specific Technology (Industrial Electronics)
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	

METHOD OF ASSESSMENT
Continuous Assessment: All the activities undertaken and competences exercised 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 technological mechanisms 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, c, e, f
II. Practicals		27.0	1.0	23.0	2.04	34.00	d, e, f, g, h, i, j, k, l
III. Assessment	4.0	2.0	1.0	24.0	1.24	20.67	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 this working time 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. Discrete and sampled systems. II. Static and dynamic analysis of discrete systems with feed-back. III. Design of regulators. Discrete conversion of continuous regulators. IV. Technological implementation of digital control systems. V. Analysis of linear systems using state variables. VI. Study of non-linear systems.
DESCRIPTION OF SKILLS
a. Knowledge and ability to model and simulate discrete systems. b. Knowledge and ability to model and simulate non-linear systems. c. Knowledge of automatic regulation and digital control techniques d. Ability to design control systems e. Ability to understand and apply the principles of a basic awareness of control engineering. f. Ability to design and tune control elements. g. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of control engineering. h. Ability to handle environments based on NICTs and the associated emergent technologies. i. Ability to set up equipment and perform practical experiments in the laboratory. j. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form. k. 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 l. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Complex Variables
Subject Area	Mathematics
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	None

METHOD OF ASSESSMENT

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

- In-class written tests
- Project work, essays and similar.
- Oral presentations
- Complementary activities.

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	15	5	0.25	30	2.01	33.5	All
I. Practicals	5.5	30	0.25	60	3.83	63.83	All
I. Assessment	3	0.5	0.5		0.16	2.67	All

TOTAL	23.5	35.5	1	90	6	100	

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

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. Complex variables.
II. Laplace transforms.
III. Fourier analysis.
IV. Z transforms.

DESCRIPTION OF SKILLS

Specific to the subject:

a. Ability to apply a knowledge of complex variables.
b. Ability to analyse and synthesize mathematical methods applied to control engineering, in particular, Laplace transforms, Z transforms, Fourier analyses and state variables.

Transferrable:

c. Capacity for critical thinking and self-critique.
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	Graphic Design II
Subject Area	Graphic Design
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired individually and/or in group-work, whether or not involving attendance at timetabled sessions, will be carried out by assigning appropriate weightings to the following activities:

- Work to be submitted for continuous assessment.
- Complementary activities.
- Examinations

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				
1. Theoretical Studies	10	18	0.5	46	3	50.3	All
2. Practicals	6	21	0.5	22	2	32.6	All
3. Assessment	4	1	1	20	1	17.1	All

TOTAL	20	40	2	88	6	100	

All teaching and learning activities of students with the instructor involve attendance at timetabled slots.
In classroom theoretical sessions, the instructor will introduce the concepts and methods of the topics covered by means of theoretical explanations and problems illustrating them.
In classroom practical sessions the instructor will aid the students with theoretical and practical applications of the systems of representation and normalization.

CONTENTS

I. Descriptive geometry II
II. Fundamentals of design
III. Normalization II
IV. Electronic drawing and symbols
V. Drawing of installations in industrial premises and in buildings
VI. Computer-aided design

DESCRIPTION OF SKILLS

a. Ability to represent systems in space.
b. Ability to handle normalized representation and drawing of sets.
c. Ability to use graphic design applied to the manufacture of integrated circuits.
d. Acquisition of theoretical and practical knowledge of normalization and the conventions used and applied by engineering professionals in technical drawings
e. Mastery of the reading needed for industrial graphic representations, so as to permit reconstruction in space of the objects shown in projections
f. Production and interpretation of normalized plans by handling and using the most suitable symbols, notes, standards and regulation.
g. Completion and reading of schematics for electric and electronic circuits and their application to the design of printed circuit boards.
h. Graphic resolution, alternative to analytic, of problems concerning installation projects.
i. Mastery of the techniques of three-dimensional CAD modelling, leading to the carrying out of the process of conception, design and development of a project in a virtual environment.

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

METHOD OF ASSESSMENT

Assessment of student work (whether or not involving attendance at timetabled sessions) and of the skills acquired, will be achieved by assigning appropriate weightings to the following activities:
- Tasks completed periodically either individually or in group work
- Oral presentations
- Complementary activities
- Examinations

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				

Theoretical Studies	24		0.2	20	1.77	29.5	a, b
Practicals	10	16	0.6	40	2.66	44.33	b, c, d
Assessment	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 the use of tools for long-distance communication.

CONTENTS

I. Technical vocabulary for electronic 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, C.V.s and application letters, face-to-face interactions, phone calls, on-line communication.

DESCRIPTION OF SKILLS

a. Ability to acquire the structural, grammatical and terminological knowledge and strategies allowing comprehension of English texts of a scientific nature relating to the field of electronic engineering.
b. Ability to gain the skills needed for drawing up and handling specifications, reports and the like in English.
c. Capacity to communicate and transmit knowledge, abilities, skills and versatility in the area of electronic engineering such as to permit students to go on to work in a multilingual and multidisciplinary environment.
d. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

SUBJECT DESCRIPTION TABLE

Subject Title	Electric Motors and Actuators
Subject Area	Electrical engineering
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired will be achieved by assigning appropriate weightings to the following activities:

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

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				
Theoretical Studies	30		1	60	3.64	60.67	a; b; c; e
Practicals	10	15	0.5	30	2.22	37	b; c; d;
Assessment	3		0.5		0.14	2.33	
TOTAL	43	15	2	90	6	100	

In theoretical studies, students' personal work (carried out without the instructor) will consist primarily of the advance preparation of the material that will be covered in classes, on lines indicated by the teaching staff, and of revising and studying this material.

Practicals will include working on problems in the application of the theoretical concepts in the subject, activities simulating actuators by means of computers and starting up some real actuators with electric machines in the workshop. Students' personal work will be directed principally towards the completing of the problems and practical requirements set and to a lesser degree towards drawing up reports on the practical work of simulation and in the workshop.

CONTENTS

I. Theory, make-up and characteristics of direct current machines.
II. Starting up, braking and controlling the speed of direct current motors.
III. Theory, make-up and characteristics of induction machines.
IV. Techniques for controlling the speed of induction motors.
V. Synchronous motors.
VI. Actuators used in automation and process control.
VII. Selecting electric machines and actuators and their energy efficiency.

DESCRIPTION OF SKILLS

a. Knowledge of the principles of operation, structure and operating characteristics of direct current and induction machinery.
b. Knowledge of techniques for starting up, braking and controlling the speed of rotary machines.
c. Ability to select and size the electric machines and actuators most suited to the various applications or situations in which they are to be used.
d. Applied knowledge of the actuators used in automation and process control.
e. Knowledge of the latest tendencies in the range of electric actuators.
f. Ability to learn independently.
g. Ability to gather and interpret accurate and useful information on the technologies available in the market.
h. Ability to choose between various options of a technical nature in accordance with criteria relating to technology, finance and sustainability.
i. Ability to work in a group.

SUBJECT DESCRIPTION TABLE	
Subject Title	Electrical Measurements and Protection
Subject Area	Electrical Engineering
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired will be achieved by assigning appropriate weightings to the following activities:

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

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				
Theoretical Studies	30		1	60	3.64	60.67	a; b; c; d; e; f; g; h; i
Practicals	10	15	0.5	30	2.22	37	b; c; e ; f ;g; h; i
Assessment	3		0.5		0.14	2.33	All
TOTAL	43	15	2	90	6	100	

In theoretical studies, students' personal work (carried out without the instructor) will consist primarily of the advance preparation of the material that will be covered in classes, on lines indicated by the teaching staff, and of revising and studying this material.

Practicals will include working on problems in the application of the theoretical concepts in the subject, activities simulating failures by means of computers and carrying out calibrations of laboratory instruments and testing protections (primarily digital). Students' personal work will be directed principally towards the completing of the problems set and to a lesser degree towards drawing up reports on calibrations and testing.

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CONTENTS

I. Basic concepts and methods for electrical measurements.
II. Calibration of measuring instruments.
III. Measuring and protective transformers.
IV. Calculation of default currents.
V. Protective technologies and methods.
VI. Adjusting and testing electric protection.

DESCRIPTION OF SKILLS

a. Knowledge of the basic principles, statistical methods and systems used in electrical measurements.
b. Ability to design and apply protocols for the calibration of electrical measuring equipment.
c. Knowledge of the characteristics and limitations of measuring and protective transformers.
d. Ability to select transformers for use in measuring and protection systems.
e. Ability to carry out basic calculations of default currents in electric installations.
f. Knowledge and practical application of the principal technologies used in the protection of electric systems.
g. Ability to calculate, adjust and test various types of electric protection.
h. Ability to learn independently.
i. Ability to work in a group.

SUBJECT DESCRIPTION TABLE

Subject Title	Electric Installations and Renewable Generation
Subject Area	Electrical Engineering
Module	Specific to ULE

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

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and skills worked on individually or in groups, whether with or without the instructor will be assessed.
Split:

- 20% will be based on work done by students during the course, either individually or in groups.
- 60% of the final mark will be based on the grades obtained during tests.
- The remaining 20% will be based on attendance at practicals (field work, laboratory or other) and the related reports on them.

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	30	4	1	48	3.32	55.33	All
II. Practicals		20	0.5	40	2.42	40.33	All
II. Assessment	3	3	0.5	0	0.26	4.34	All
TOTAL	33	27	2		6	100	

Students will spend at least 5% of their working time without the instructor on preparing classes, reading materials previously indicated to them by the teaching staff.
Student work with the instructor will involve attendance at timetabled sessions, initially amounting to 90%. The remainder will be based on the use of tools for distance learning. These percentages will evolve as a function of the tools available.
In the S-type working sessions the instructor will guide students in the application of theoretical and practical concepts and results to the solving of problems and modelling in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups.

CONTENTS

I. Electric installations. Calculation and sizing.
II. Regulations and standards that must be observed in low-voltage installations.
III. Electric protection. Types, selection, size.
IV. Safety in electric installations.
V. Wind power
VI. Photovoltaic power.

DESCRIPTION OF SKILLS

a. Ability to size and calculate low-voltage electric installations.
b. Ability to interpret, understand and apply the standards and regulations that must be observed in low-voltage installations.
c. Ability to understand and identify protective equipment, its parameters, and the selection, co-ordination and sizing of such equipment.
d. Ability to understand the operating principles of the generation of electric power from wind resources.
e. Ability to understand the operating principles of the generation of electric power by means of photovoltaic conversion.

SUBJECT DESCRIPTION TABLE	
Subject Title	Telecommunications in Industry
Subject Area	Communications

Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment will be continuous and will take into consideration the following aspects: mastery of theoretical and operational knowledge of the subject; attendance at, and participation in, debates and individual and/or group work; completion of the work or exercises set; individual contributions by students to classes.

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				
Theoretical Studies	30		0.5	45	3.02	50.3	a, b, c, e, f
Practicals	19	7.5	0.25	35	2.47	41.2	a, b, c, d, e, f, g
Assessment	2		0.75	10	0.51	8.5	All
TOTAL	51	7.5	1.5	90	6	100	

Student working time with teaching staff will in its totality involve attendance at timetabled slots.

Students will follow the indications of the teaching staff relating to study, reading of texts and the preparation of materials before each theory or practical session, this work to be done during student working hours without the presence of an instructor.

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

In practical sessions in the classroom, the instructor will guide the students in the application of concepts and results for resolving problems, at all times encouraging analysis and critical thinking. Exercises will be provided 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 in independent work, in gaining a knowledge of safety and behaviour standards and in the handling of laboratory instruments and tools. Real or simulated experiments will be performed to complement and exemplify the points covered in classroom sessions and the working methods of the subject.

CONTENTS

I. Introduction to telecommunication networks and services.
II. Signals and information. Synchronicity requirements. Transmission speed and bandwidth.
III. Physical means. Modulation. Spectrum use.
IV. Analog and digital transmission. Signal/noise ratio and error rate.
V. Sampling and coding. Multiplexing, digital layers and hierarchies. Standardization
VI. Interfaces. Modems and coder-decoders (codecs). Levels and protocols.

DESCRIPTION OF SKILLS

a. Theoretical and applied knowledge of the current telecommunication systems, networks and services applicable to industrial electronics.
b. Knowledge of interfaces, protocols, modulation techniques, equipment, systems and technologies for transmitting analog and digital signals with applications in industrial electronics.
c. Ability to take decisions, and to analyse and solve problems with initiative, creativity and critical thinking.
d. Ability to carry out measurements and calculations and handle specifications, regulations and

standards.

e. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.
f. Capacity for independent learning.
g. Ability to work in a team, taking on roles and responsibilities, organizing and planning with an emphasis on quality while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.

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

METHOD OF ASSESSMENT

All the activities set and skills worked on at individual and group level, whether or not undertaken with an instructor present, will be assessed.
The final mark will be the result of combining:
- Continuous assessment marks.
- Marks from the various tests held.

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				
Theoretical Studies	16	10	0.5	37	2.54	42.33	a, b, d, f
Practicals	2	29	0.5	31	2.5	41.67	a, b, c, e
Assessment	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 scheduled as involving only some of the students (type S in the table above), 50% will be in groups of five students. In such sessions the students will be taught both the techniques for working as a team and those for independent learning. The remaining 50% of such teaching and learning activities will be in groups of between 10 and 15 students.
At least 5% of the working time scheduled to be with an instructor will not involve attendance at a scheduled slot. This will be by means of computer software for communication at a distance. As such tools improve and become more widespread, this proportion of time will increase.

CONTENTS

I. Architecture and types of systems and services on the Internet.
II. Structure and characteristics of various Internet services.
III. Models and architectures of mobile and wireless networks.
IV. Technologies, equipment and protocols.
V. Security in mobile and wireless networks.

DESCRIPTION OF SKILLS

a. Applied knowledge of Internet services

b. Applied knowledge wireless communications networks c. Ability to learn independently when solving problems. d. Development of the learning skills necessary for continuing with further studies. e. Ability to work in a group. f. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Communications Networks
Subject Area	Communications
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 set and skills worked on at individual and group level, whether or not undertaken with an instructor present, will be assessed.
The final mark will be the result of combining:

- Continuous assessment marks.
- Marks from the various tests held.

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				
Theoretical Studies	16	10	0.5	37	2.54	42.33	a, b, d, f
Practicals	2	29	0.5	31	2.5	41.67	a, b, c, e
Assessment	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 scheduled as involving only some of the students (type S in the table above), 50% will be in groups of five students. In such sessions the students will be taught both the techniques for working as a team and those for independent learning. The remaining 50% of such teaching and learning activities will be in groups of between 10 and 15 students.
At least 5% of the working time scheduled to be with an instructor will not involve attendance at a scheduled slot. This will be by means of computer software for communication at a distance. As such tools improve and become more widespread, this proportion of time will increase.

CONTENTS

I. Introduction to network architecture and the principal models of network.
II. Types of networks and switching technologies.
III. Functions and protocols of the data link layer and control of access to the medium.
IV. Functions, protocols and types of service of the network layer. Quality of service.
V. Services and protocols of the transport layer.
VI. Introduction to higher layers.
VII. Network devices and interconnection.
VIII. The Internet.

DESCRIPTION OF SKILLS

a. Theoretical and applied knowledge of the architecture of public and private telecommunications

networks, of the services they provide and of the protocols they use.
b. Knowledge of the technologies and of the electronic equipment with which networks operate.
c. Ability to learn independently when solving problems.
d. Development of the learning skills necessary for continuing with further studies.
e. Ability to work in a group.
f. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Development and Construction of Prototypes
Subject Area	Electronic Systems
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Technology and Fundamentals of Electronics, Analog Electronics, Digital Electronics and Power Electronics.

METHOD OF ASSESSMENT

Assessment will be continuous and will take into consideration the following aspects: mastery of theoretical and operational knowledge of the subject; attendance at, and participation in, debates and individual and/or group work; completion of the work or exercises set; individual contributions by students to classes.

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				
Theoretical Studies	16		0.5	24	1.62	27	a, b, c, g, h
Practicals		38	0.5	46	3.38	56.33	a, b, c, d, e ,f, g, i
Assessment	2	2	1	20	1	16.67	All
TOTAL	18	40	2	90	6	100	

About 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.

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

In practical work sessions, the instructor will guide students in their independent work, introducing them to the creative solution of problems, knowledge of the safety, hygiene and behaviour standards required at work, the use of the instruments and tools of the subject laboratory and the tools and techniques for designing electronic systems. They will be required to develop, simulate and/or construct prototypes of electronic systems performing some useful function for different industrial environments.

CONTENTS

I. Principles and techniques of design, implementation and documentation.
II. Technologies, methods and tools for simulation, manufacture and prototype construction.
III. Development of prototypes.

DESCRIPTION OF SKILLS
a. Ability to specify, design, simulate and implement circuits, equipment and electronic systems, whether analog, digital, pulsed, with added intelligence, power or mixed. b. Knowledge of the technologies for manufacturing and assembling, design and simulation tools for the electronic components, integrated circuits, hybrid modules and printed circuit boards that form electronic systems. c. Ability to take decisions, and to analyse and solve problems with initiative, creativity and critical thinking. d. Ability to carry out measurements and calculations and handle specifications, regulations and standards. e. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills. f. Capacity for organization and planning with an emphasis on quality. g. Capacity for independent learning. h. Ability to work in a team, taking on roles and responsibilities, while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.

SUBJECT DESCRIPTION TABLE	
Subject Title	Instrumentation, Remote Control and Telemetry
Subject Area	Electronics
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment will be continuous and will take into consideration the following aspects: mastery of theoretical and operational knowledge of the subject; attendance at, and participation in, debates and individual and/or group work; completion of the work or exercises set; individual contributions by students to classes.

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				
Theoretical Studies	26		0.5	40	2.66	42.7	a, b, c, e, f
Practicals	23	7.5	0.25	40	2.83	42	a, b, c, d, e, f, g
Assessment	2		0.75	10	0.51	15.3	All
TOTAL	51	7.5	1.5	90	6	100	

All student working time with an instructor will involve attendance at timetabled slots.

Students will follow the instructors indications concerning study, reading of texts and preparation of materials prior to each theoretical or practical session, such work to be carried out during the time assigned for working without an instructor.

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

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

In practical sessions in the laboratory, the instructor will guide the students in independent work, giving them a knowledge of safety and behaviour standards, and of the use of the instruments and tools of the laboratory.

Real or simulated experiments will be performed that will complement and exemplify the materials covered in classes and the working methods of the subject area.

CONTENTS

DESCRIPTION OF SKILLS

a. Ability to specify, design and calibrate electronic instruments
b. Knowledge of systems for data acquisition, sensors, transducer, signal processing and treatment and error estimation.
c. Ability to take decisions, and to analyse and solve problems with initiative, creativity and critical thinking.
d. Ability to carry out measurements and calculations and handle specifications, regulations and standards.
e. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.
f. Capacity for independent learning.
g. Capacity for organization and planning with an emphasis on quality.
h. Ability to work in a team, taking on roles and responsibilities, while showing absolute respect for basic rights and not discriminating on grounds of sex, race, age or religion.

SUBJECT DESCRIPTION TABLE

Subject Title	Artificial intelligence and Nanotechnology
Subject Area	Intelligent Systems in Engineering
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 set and skills worked on at individual and group level, whether or not undertaken with an instructor present, will be assessed.
The final mark will be the result of combining:

- Continuous assessment marks.
- Marks from the various tests held.

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				
Theoretical Studies	16	10	0.5	37	2.54	42.3	a, c, e
Practicals	2	29	0.5	31	2.5	41.6	a, b, d
Assessment	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 scheduled as involving only some of the students (type S in the table above), 50% will be in groups of five students. In such sessions the students will be taught both the

techniques for working as a team and those for independent learning. The remaining 50% of such teaching and learning activities will be in groups of between 10 and 15 students.
At least 5% of the working time scheduled to be with an instructor will not involve attendance at a scheduled slot. This will be by means of computer software for communication at a distance. As such tools improve and become more widespread, this proportion of time will increase.

CONTENTS

I. Historical introduction to artificial intelligence.
II. Techniques and methods in artificial intelligence.
III. Representation of knowledge.
IV. Expert and knowledge-based systems.
V. Areas of application of artificial intelligence in engineering.
VI. General concepts of nanotechnology.
VII. Nano robots.

DESCRIPTION OF SKILLS

a. Knowledge of artificial intelligence techniques and their application to the various different areas of engineering.
b. Applied knowledge of nanotechnology in engineering.
c. Ability to learn independently when solving problems.
d. Development of the learning skills necessary for continuing with further studies.
e. Ability to work in a group.
f. Development of spoken and written communication.

SUBJECT DESCRIPTION TABLE	
Subject Title	Household and Integral Building Automation
Subject Area	Intelligent Systems in Engineering
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and competences exercised 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	32.0		1.0	35.0	32.0		a, b, d

Practicals		27.0	1.0	23.0		27.0	c, d, e, f, g, h, i
Assessment	4.0	2.0	1.0	24.0	4.0	2.0	All
TOTAL	36.0	29.0	3.0	82.0	36.0	29.0	

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. General concepts of household and integral building automation (domotics and inmotics).
II. Sensors and actuators used in household or integral building systems.
III. Technologies and layouts for household or integral building automation systems.
IV. Control systems: centralized, decentralized and distributed architectures.
V. Monitoring systems for household or integral building automation installations.
VI. Developing a household or integral building automation project.

DESCRIPTION OF SKILLS

a. Ability to design household and integral building automation installations.
b. Ability to carry out technical inspections and maintenance of household and integral building automation installations.
c. Ability to set up equipment and carry out basic experiments in the laboratory.
d. Ability to use strategies for monitoring and energy efficiency in housing and buildings used by the service sector.
e. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of automation, control and monitoring systems.
f. Ability to handle environments based on NICTs and the associated emergent technologies.

g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form.
h. 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.
i. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Industrial Instrumentation
Subject Area	Advanced Control
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and competences exercised 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, d
Practicals		27.0	1.0	23.0	2.04	34.00	c, d, e, f, g, h, i
Assessment	4.0	2.0	1.0	24.0	1.24	20.67	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 industrial instrumentation.
II. Measuring devices.
III. Intelligent instrumentation.
IV. Final control elements.
V. Field buses and protocols most often used in industrial instrumentation.
VI. Virtual instrumentation.
VII. Standards relating to industrial instrumentation.

DESCRIPTION OF SKILLS

a. Knowledge of the industrial instrumentation used in industrial systems and processes.
b. Ability to calculate, fix parameters, adjust and calibrate industrial instrumentation.
c. Ability to select the most appropriate type of measuring device for the needs of industrial installations.
d. Ability to program virtual instruments.
e. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of automation, control and monitoring systems.
f. Ability to handle environments based on NICTs and the associated emergent technologies.
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form.
h. 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.
i. Capacity for team work.

SUBJECT DESCRIPTION TABLE	
Subject Title	Industrial Monitoring
Subject Area	Advanced Control
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester

Prerequisites	

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and competences exercised 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 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, c
Practicals		27.0	1.0	23.0	2.04	34.00	c, d, e, f, g, h
Assessment	4.0	2.0	1.0	24.0	1.24	20.67	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. Structure of a monitoring system. II. Local and remote monitoring. III. Acquisition, processing and storing of industrial variables. IV. Features of plant operation. SCADA systems. V. Advanced monitoring tools. VI. Remote monitoring via the Internet.

DESCRIPTION OF SKILLS
a. Ability to design monitoring systems for industrial processes, whether local or remote. b. Knowledge of the classic and emerging technologies applied to monitoring systems. c. Ability to analyse and apply technologies for recording events, alarms, error detection and logging. 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 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, in spoken or written form. 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. Capacity for team work.

SUBJECT DESCRIPTION TABLE	
Subject Title	Control Techniques
Subject Area	Advanced Control
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

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 for each ECTS credit)		ECTS	%	Related Skills
	With Instructor	Without			

		C	S	T	Instructor			
I.	Theoretical Studies	32.0		1.0	35.0	2.72	45.33	a, b, c
II.	Practicals		27.0	1.0	23.0	2.04	34.00	d, e, f, g, h, i,
III.	Assessment	4.0	2.0	1.0	24.0	1.24	20.67	
	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. System identification.
II. Multivariable control.
III. Control of electric actuators.
IV. Modern control techniques.
V. Technological implementation.

DESCRIPTION OF SKILLS

a. Knowledge of algorithms for the identification, optimization and control of systems and processes.
b. Capacity for technological implementation of control strategies in both industrial and non-industrial processes.
c. Knowledge of methods of control other than classic systems.
d. Ability to use techniques for system identification.
e. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of automation, control and monitoring systems.

f. Ability to handle environments based on NICTs and the associated emergent technologies.
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form.
h. 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.
i. Capacity for team work.

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.

CONTENTS

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 industrial engineering of a professional nature, which will bring together and integrate the skills acquired during the programme of studies.
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.
	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 industrial 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.