University of Leon

Graduate in Mechanical Engineering

Memorandum

School of Industrial and Computer Engineering

2009

Contents

1 Description of the Qualification

1.1 Name of the Qualification

- Graduate in Aerospace Engineering of the University of Leon

1.2 Requesting University and Department

- University of Leon
- School of Industrial and Computer Engineering

1.3 Address for Correspondence

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

1.4 Representative of the University

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

1.5 Contact Person for the Qualification

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

1.6 Type of Instruction

- With attendance

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

1.7 Number of Places Available per Year's Intake

- One hundred places will be available for each fresh year's intake of students.
- This degree is proposed as a reworking of the course leading to the qualification of Technical Industrial Engineer, with specialism in Mechanical Engineering,

and special subject Industrial Installations and Structures, currently taught at the University of Leon.

- Over the last five years the average enrolment for that qualification was 80 students.

1.8 Number of Credits and Enrolment Requirements

NUMBER OF CREDITS

- The proposed degree will comprise 240 ECTS credits.

ENROLMENT REQUIREMENTS

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

NORMS FOR CONTINUED GOOD STANDING

- Article 128 of the Statutes of the University of Leon lays down that the *Consejo Social* [Social Board] of the University, at the proposal of the *Consejo de Gobierno* [Governing Body] on the basis of a prior report from the *Consejo de Coordinación Universitaria* [University Co-ordination Board], shall fix the maximum number of attempts that a student may be permitted in order to pass the examinations for a subject and the maximum periods for which students may remain registered in good standing for courses taught by the University and leading to qualifications issued by it, in accordance with the nature of the relevant programme of studies. As the provisions of this Article have not yet been activated, the current regulations governing these matters are those established by Spanish Royal Decree-Law 8/1976, of 16 June 1976, Resolutions of the *Junta* [Standing Committee] or the Governing Body, and decisions the Vice-Chancellor, which together stipulate the following:

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

1.9 Further Information Required for Issue of the European Supplement.

TYPE OF INSTITUTION AWARDING THE QUALIFICATION

- State University

Nature of the University Centre Involved

- School within the requesting University

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

- Technical 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

- Mechanics
- Construction
- Fabrication Engineering
- Electricity
- Applied Thermodynamics
- Industrial Installations
- Design of Machinery

2 Teaching Plan

2.1 Structure of the Course

In accordance with *Order CIN/351/2009, of 9 February 2009 (published in the Spanish Official Gazette on 20 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 (Mechanical Engineering)		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, electricity and magnetism 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	• A knowledge of applied thermodynamics and the transmission of heat. Basic principles and their application to the solving of 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 pipe-work, channels and fluid systems.	Comp
Chemical Engineering	6	•Basic knowledge and applications of environmental technologies and sustainability.	Comp
Resistance of Materials	12	Knowledge and use of the principles of resistance of materials.	Comp
Mechanical and Fabrication Engineering	12	• Knowledge of the fundamentals of materials science, technology and chemistry. Understanding of the relationship between microstructure, synthesis or processing and the properties of materials. • Knowledge of the principles of the theory of machinery and mechanisms. • Basic knowledge of systems for production and fabrication.	Comp
Electrical Engineering	6	• Knowledge and use of the principles of the theory of electric machines and circuits.	Comp
Electronics and Automation	6	•Knowledge of the fundamentals of electronics. •Knowledge of the fundamentals of automata and control methods.	Comp
Projects	6	•Knowledge and capacity 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 (Mechanics)			
Subject Area	ECTS	Skills	Type
Physics	12	• Applied knowledge of heat engineering. • Applied knowledge of the fundamentals of hydraulic systems and machinery.	Comp
Graphic Design	6	• Knowledge of, and ability to apply, graphic techniques for engineering.	Comp
Mechanical and Fabrication Engineering	18	• Knowledge of, and ability to apply, materials engineering. • Applied knowledge of systems and processes of fabrication, metrology and quality control. • Knowledge and capacities for calculating, designing and trialling machinery.	Comp
Mechanics of Continuous Media and Theory of Structures	12	• Knowledge of, and capacity to apply, the fundamentals of elasticity and resistance of materials to the behaviour of real solids. • Knowledge and capacity for calculating and designing industrial structures and buildings.	Comp

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type
Mathematics	6	• Capacity to analyse and synthesize mathematical models applied to mechanical engineering, in particular those based on differential methods. • Understanding and mastery of the various methods for approximate resolution of problems in mechanical engineering and skill in the use of the appropriate computing tools.	Comp
Physics	6	• Capacity to predict through calculations the behaviour of components and systems in which forces and movements come into play. • Capacity to grasp the formalisms of the general theory of dynamic systems.	Comp
	12	• Applied knowledge of industrial noise, its propagation, attenuation, absorption and insulation. Capacity to solve problems related to the control of noise and vibration. Noise and vibration in the workplace. • Applied knowledge of systems for producing cold and the mechanisms of the transmission of heat for later application to the design of equipment for heat transfer, calculating thermal loads and designing machines for mechanical compression and absorption. • Capacity to design, calculate and maintain refrigerated installations.	Opt
Electrical Engineering	6	• Applied knowledge of electrical technology.	Comp
	6	• Ability to design and calculate low-voltage electric installations. • Capacity to work with regulations and obligatory standards for low-voltage installations • Applied knowledge of lighting technology. • Knowledge of electrical safety and protection.	Opt
English	6	• Capacity to acquire structural, grammatical and terminological knowledge and strategies permitting the understanding of English texts of a scientific nature from the field of mechanical engineering. • Capacity to acquire the skills necessary for the drawing up and handling of specifications, reports and similar documents in English. • Capacity to communicate and transmit knowledge, abilities, skills and versatility in the field of mechanical engineering such as to permit students to work in a multilingual and multidisciplinary context.	Comp
Electronic Instrumentation	6	• Basic knowledge of instrumentation, transducers, sensors, signal conditioning and processing, data display and error estimation.	Opt

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type
Mechanical and Fabrication Engineering	24	• Knowledge of the calibration chain and its application to quality-control systems. • Knowledge of the fundamentals of advanced fabrication processes • Knowledge of preparations for the production process: programs, tools and equipment. • Knowledge of quality-control techniques based on attributes and variables and their application to the calculation of tolerances. • Capacity to recognize and use the information managed by computers as applied to the production process: computer-aided design, computer-aided manufacture, computer integrated manufacture. • Capacity to use and program programmable logic controllers, computer numeric control and process control instrumentation in integrated manufacturing processes. • Applied knowledge of welding techniques. • Fundamental knowledge of nanotechnology applied to the manufacture of mechanical systems.	Opt
Mechanics of Continuous Media and Theory of Structures	24	• Knowledge of the calculations needed for structures made of reinforced or pre-tensed concrete. • Knowledge of the calculations needed for metal structures. • Knowledge and applications of soil mechanics and foundations. • Knowledge and use of elastoplasticity theory. • Capacity to apply elastoplasticity theory to shaping processes	Opt

Module: Final Year Project			
Subject Area	ECTS	Skills	Type
Final Year Project	12	• An original project to be carried out individually and presented and sustained before a university board of examiners, consisting of a piece of work in the area of the specific technologies of Industrial Engineering of a professional nature, bringing together and integrating the skills acquired during the course 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 Engineering in Industrial Electronics and Automation
   - 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
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 and Fluid Mechanics	6	Comp
		Applied Thermodynamics and Fluid Mechanics	6	
Chemical Engineering	6	Environmental Technology	6	Comp
Resistance of Materials	12	Resistance of Materials I	6	Comp
		Resistance of Materials II	6	
Mechanical and Fabrication Engineering	12	Materials Science	6	Comp
		Theory of Machines and Mechanisms	6	
Electrical Engineering	6	Principles of Electric Machines and Circuits	6	Comp
Electronics and Automation	6	Automatic Regulation	6	Comp

Projects	6	Project Management	6	Comp

Module: Specific Technology (Mechanics)				
Subject Area	ECTS	Subjects	ECTS	Type
Physics	12	Industrial and Building Installations I	6	Comp
		Industrial and Building Installations II	6	
Graphic Design	6	Graphic Design II	6	Comp
Mechanical and Fabrication Engineering	18	Design of Machines	6	Comp
		Fabrication Engineering	6	
		Mechanical Technology	6	
Mechanics of Continuous Media and Theory of Structures	12	Theory of Structures I	6	Comp
		Theory of Structures II	6	

Module: Specific to ULE				
Subject Area	ECTS	Subjects	ECTS	Type
Mathematics	6	Numerical Methods in Engineering	6	Comp
Physics	18	Mechanics	6	Comp
		Acoustics and Vibrations	6	Opt
		Refrigeration Engineering	6	Opt
Electrical Engineering	12	Multiphase Systems and Electric Machines	6	Comp
		Industrial Electricity	6	Opt
English	6	English	6	Comp
Electronic Instrumentation	6	Electronic Measurements and Instruments	6	Opt
Mechanical and Fabrication Engineering	24	Metrology and Quality Control	6	Opt
		Process Planning	6	
		Advanced Fabrication Processes	6	
		Integrated Manufacturing	6	
Mechanics of Continuous Media and Theory of Structures	24	Study of Elastoplasticity in Forming Processes	6	Opt
		Concrete Structures	6	
		Metal Structures	6	
		Ground Engineering	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 I	6	Numerical Methods in Mechanical Engineering	6
Mathematical Methods in Engineering	6	Thermodynamics and Fluid Mechanics	6
Principles of Electric Machines and Circuits	6	Fundamentals of Business Administration	6
Mechanics	6	Resistance of Materials II	6
Materials Science	6	Automatic Regulation	6
TOTAL	30	**TOTAL**	30

Third Year

Fifth Semester		Sixth Semester	
Subject	ECTS	Subject	ECTS
Theory of Structures I	6	Theory of Structures II	6
Fabrication Engineering	6	Theory of Machines and Mechanisms	6
Multiphase System and Electric Machines	6	Environmental Technology	6
Applied Thermodynamics and Fluid Mechanics	6	Option 1	6
Mechanical Technology	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	Industrial and Building Installations II	6
Industrial and Building Installations I	6	Design of Machines	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
Ingeniørhøjskolen i Aarhus	Denmark
Ingeniørhøjskolen i Kobenhavn	Denmark
Vitus Bering	Denmark
University of Maribor	Slovenia
École d'Ingénieurs 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 Ferrara	Italy
Università degli Studi di Napoli Federico II	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 Guarda	Portugal
Instituto Politécnico Porto	Portugal
Instituto Superior Técnico Lisboa	Portugal
Instituto Politécnico de Leiria	Portugal
Universidade de Coimbra	Portugal
Universidade de Evora	Portugal
Universidade de Tras os Montes e Alto Douro	Portugal
Universidade do Minho	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
Universidad de Medellín	Colombia
Universidad Tecnológica De Pereira	Colombia
Centro Universitario José Martí Pérez de Sancti Spiritus	Cuba
University of Rikkyo	Japan
Universidad Autónoma de Coahuila	Mexico
Universidad de Colima	Mexico
Universidad Autónoma de Guadalajara	Mexico
Universidad de La Salle Bajío	Mexico
Universidad Iberoamericana de León	Mexico
Instituto Tecnológico de Monterrey (Campus De León)	Mexico
Universidad Iberoamericana de León	Mexico
Universidad de las Américas-Puebla	Mexico
Benemérita Universidad Autónoma de Puebla	Mexico
Universidad Autónoma del Estado de México	Mexico
Universidad Veracruzana	Mexico
Universidad César Vallejo Filial Piura	Peru
Universidad Columbia del Paraguay	Paraguay
International University Moscow	Russia

University	Country
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 (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	All
Practicals		27		51	3.13	52.17	All
Assessments	6	0	0.25	9	0.60	10	All
TOTAL	24	35.5	0.50	90	6	100	

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

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

(d) Capacity to communicate in writing in Spanish which is correct and mathematically rigorous

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		60	3.85	64.17	All
3. Assessment	6		0.25		0.24	4	All
TOTAL	24	35.5	0.5	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 75 students.

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

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

CONTENTS

I. 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				
I. Theoretical Studies	12	8.5	0.25	30	2.03	33.83	All
II. Practicals	6	27		60	3.73	62.17	All
III. Assessment	6		0.25		0.24	4	All
TOTAL	24	35.5	0.5	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

- 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. Capacity 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 handed in.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
Theoretical	18	8.5	0.25	30	2.27	37.83	a, b, c
Practicals		27		51	3.13	52.17	a, b, c
Assessment	5	1	0.25	9	0.60	10	All
TOTAL	23	36.5	0.50	90	6	100	

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

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

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	

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				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. Assessments	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. Thermodynamics: Heat. The first law of thermodynamics. The second law of thermodynamics.

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	

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				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	30		1	40	2.84	47.3	a.b.c.d
2. Practicals	10	15	1	28	2.16	36.0	a.b.c.d.e.f
3. Assessment	4		1	20	1	16.7	All
TOTAL	44	15	3	88	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

In S-type classroom sessions, instructors 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 sessions of type S may involve laboratory practicals. In these, the instructor will guide the students to an awareness of safety and behaviour standards and the use of various instruments.

CONTENTS

I. Thermodynamics: heat. The first law of thermodynamics. The second law of thermodynamics.
II. Study and description of the concept of field. Perturbations in the sources of fields. Waves.
III. Electricity and magnetism: Gauss' law. Ampère's law. Faraday's law. Maxwell's equations.

DESCRIPTION OF SKILLS

a. Understanding and mastery of the basic concepts of the general laws of thermodynamics and their application to the solving of problems typical of engineering.
b. Understanding and mastery of the basic concepts of fields and waves, and their application to the solving of problems typical of engineering.
c. Understanding and mastery of the basic concepts of the general laws of electricity and magnetism and their application to the solving of problems typical of engineering.
d. Ability to perform and interpret calculations on the basis of the experiments undertaken.
e. Ability to learn independently.
f. 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 Instructor			
	C	S	T				
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. Assessments	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				
I.Theoretical Studies	10	18	0.5	46	3	50	All
II.Practicals	6	21	0.5	22	2	33.3	All
III.Assessment	4	1	1	20	1	16.7	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 through the traditional methods of matrix and descriptive geometry, and by means of computer-aided design applications. b. Knowledge and capacities for the application of the techniques of graphical engineering. c. Spatial visualization. d. Operational graphic capacity. e. Acquiring theoretical and practical knowledge of normalization and the conventionalisms used and applied by engineering professionals in technical drawing. f. Mastery of the readings needed for industrial graphical representations, such as to allow reconstruction in space of objects shown in projections. g. 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	20		1.25	22	1.73	28.8	All
2. Practicals		35	1.25	44	3.21	53.5	All
3. Assessments	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

a. Basic components of hardware.
b. Operating systems: start-up.
c. Flow-charts for information management.
d. Data structures.
e. Databases.
f. Basic algorithms applicable to engineering.
g. 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	Fourth 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				
I. Theoretical Studies	20	2	0.2	22	1.77	29.50	a. b. c
II. Practicals	10	20	0.3	40	2.81	46.83	a. b. c. d. e
III. 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. The institutional and legal context
III. Business management and the decision-making process. Organization and management
IV. Business development and growth
V. Introduction to human resources management in businesses
VI. Introduction to operational management
VII. Introduction to sales management
VIII. Introduction to financial management

DESCRIPTION OF SKILLS

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

SUBJECT DESCRIPTION TABLE	
Subject Title	Thermodynamics and Fluid Mechanics
Subject Area	Physics
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS credits	6
Scheduling	Fourth Semester
Prerequisites	

METHOD OF ASSESSMENT

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

- Work submitted at intervals, either individual or group tasks.
- Reports on activities.
- A written examination with theoretical and practical questions

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	26		1	40	2.68	44.7	a,b,e
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	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

In S-type classroom sessions, instructors 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 sessions of type S may involve laboratory practicals or visits to companies. In these, the instructor will guide the students to an awareness of safety and behaviour standards and the use of various instruments.

CONTENTS

I. Heat technology: transmission of heat. Gas power cycles. Steam power cycles. Cooling cycles. Psychrometry.
II. Fluid mechanics: statics and dynamics of fluids. Dimensional analysis and hydraulic similarity.

DESCRIPTION OF SKILLS

a. Knowledge of applied thermodynamics and the transmission of heat.
b. Knowledge of the basic principles of fluid mechanics.
c. Ability to set up equipment and carry out practical laboratory experiments.
d. Ability to perform and interpret calculations for the experiments and problems undertaken.
e. Capacity of students to interpret relevant data sets so as to be able to form and express opinions involving thought about appropriate topics of a social, scientific or ethical nature.
f. Ability to learn independently.
g. Ability to work in a team.

SUBJECT DESCRIPTION TABLE

Subject Title	Applied Thermodynamics and Fluid Mechanics
Subject Area	Physics
Module	Common Core for Industrial Subjects

Type	Compulsory
Number of ECTS credits	6
Scheduling	Fifth Semester
Prerequisites	

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, individually or in group work, will be achieved by consideration and weighting of the following activities:

- Work for submission completed out at intervals, whether individually or in a group (20%)
- A final written examination on the theoretical and practical material covered (80%).

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	20	2	1	28	2.04	34.00	a,b,c
II.Practicals	15	18	1	40	2.96	49.33	a,b,c,d,e,f
III.Assessment	4		1	20	1.00	16.67	All
TOTAL	39	20	3	88	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

In classroom theoretical and practical sessions the instructor will introduce concepts, results and methods for calculations, with their applications to specific cases, by means of theoretical explanations and illustrative examples.

In S-type classroom sessions, instructors will provide exercises of appropriate complexity to solve, using current regulations and obligatory standards. Thereafter, these exercises will be completed, together with others of greater difficulty, by means of software produced by different brands in the sector, so as to develop projects in a realistic and up-to-date form.

Groups of four or five students will be formed to undertake practical work set for each of these groups. The instructor will clarify all questions arising during the completion of this work.

CONTENTS

I. Thermodynamics:

Block 1.- Applications to heat transmission in building.
Block 2.- Application to mass heat transfer and transmission in industry.
Block 3.- Heat pumps.
Block 4.- Cogeneration and trigeneration.

II. Fluid Mechanics:
Block 5.-Applications to sizing pipe work networks.
Block 6.- Application to water supply installations.
Block 7.-Application to sewage and drainage networks in towns and buildings.

DESCRIPTION OF SKILLS

a. Knowledge of applied thermodynamics and heat transmission. Basic principles and

their application to solving problems in engineering.
b. Knowledge of the basic principles of fluid mechanics and their application to solving problems in the field of engineering.
c. Calculations for pipe work, channels and fluid systems.
d. Ability to learn independently.
e. Ability to work in a team.
f. Capacity to carry out measurements, calculations, assessments, evaluations, expert opinions, studies, reports, work plans and other similar work in the field covered by this subject.
g. Capacity to handle specifications, regulations and required standards in the field covered by this subject.

SUBJECT DESCRIPTION TABLE	
Subject Title	Environmental Technology
Subject Area	Chemical Engineering
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS credits	6
Scheduling	Sixth Semester
Prerequisites	None

METHOD OF ASSESSMENT

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

- Work submitted at intervals, either individual or group tasks.
- Reports on activities in the computer laboratory
- Oral presentations.
- 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	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

In S-type classroom sessions, instructors 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.

In practical work sessions in the computer laboratory, the instructor will guide the students in the use of simulation programs for calculating installations of an environmentally friendly nature. Students will undertake exercises complementing and exemplifying the points covered in classes and in them will apply the tools for solving problems that they have acquired. Each student will give a presentation on a topic set by the instructor relating to visits paid to industrial installations linked to the environment.
CONTENTS
I. Problems of air and water pollution, and of pollution by waste: legal aspects, sources, indicator parameters. II. Waste-water treatment III. Control of atmospheric pollution IV. Waste V. Environmental management in industry and sustainability
DESCRIPTION OF SKILLS
a. Basic knowledge and application of environmental technologies and of sustainability b. Critical thinking c. Decision making d. Sensitivity towards environmental topics e. Creativity and innovation

SUBJECT DESCRIPTION TABLE	
Subject Title	Resistance of Materials I
Subject Area	Mechanics of Continuous Media and Theory of Structures
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				
I.Theoretical Studies	30		2	31	2.52	42	All
II.Practicals		30	1	31	2.48	41.33	All
III.Assessment	9	3	1	12	1	16.67	All

TOTAL	39	33	4	74	6	100	

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

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

In classroom practical sessions, instructors 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.

CONTENTS

I. Basic concepts of tension and deformation.
II. Pieces with elasticity: bar model, laws of stresses and strains.
III. Axial stresses and strains: tensions and deformations.
IV. Tensions caused by flexion.
V. Tensions caused by shearing.
VI. Tensions caused by torsion.
VII. Tensions caused 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. Ability to learn independently.
d. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Resistance of Materials II
Subject Area	Mechanics of Continuous Media and Theory of Structures
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS credits	6
Scheduling	Fourth semester
Prerequisites	Physics, Mathematics, Resistance of Materials I

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			

	C	S	T	Instructor			
I.Theoretical Studies	30		2	31	2.52	42	All
II.Practicals		30	1	31	2.48	41.33	All
III.Assessment	9	3	1	12	1	16.67	All
TOTAL	39	33	4	74	6	100	

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

In classroom theoretical and practical 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, instructors 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.

CONTENTS

I. Deformational energy: principle of virtual work.
II. Calculation of turning and displacements in bar structures.
III. Hyperstatic structures.
IV. Lateral flexing of bars.
V. Theory of cables.
VI. Introduction to the theory of plates.

DESCRIPTION OF SKILLS

a. Knowledge and use of the principles of the resistance of materials.
b. Capacity to analyse and solve problems.
c. Ability to learn independently.
d. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Materials Science
Subject Area	Mechanical and Fabrication Engineering
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS credits	6
Scheduling	Third semester
Prerequisites	Chemistry

METHOD OF ASSESSMENT

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

- Examinations
- Work submitted at intervals, either individual or group tasks.
- Reports on activities in the laboratory

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		0.5	40	2.82	47	a,b,c,e,g
II.	Practicals		24	1	15	1.6	26.67	All
III.	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 introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative 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 in gaining acquaintance with safety and behaviour standards in the use of the equipment and basic instruments of a materials laboratory. Students will perform simple experiments that complement and exemplify the topics covered in classes.

CONTENTS

I. **Fundamentals of Materials Science.** Crystalline structure. Processes of diffusion. Mechanical properties. Phase transformations.

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

III. **Other Properties of Materials.** Electrical and magnetic properties. Thermal and optical properties. Resistance to corrosion

IV. **Selecting Materials.**

DESCRIPTION OF SKILLS

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

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

c. Acquisition of knowledge and abilities to apply materials engineering.

d. Effective development of spoken and written communication.

e. Ability to learn independently.

f. Capacity for team work.

g. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Theory of Machines and Mechanisms
Subject Area	Mechanical and Fabrication Engineering
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS credits	6
Scheduling	Sixth 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				
I.Theoretical Studies	30		1	40	2.84	47.33	a,b,c,g
II.Practicals	4	20	1	15	1.6	26.67	d,e,f,g
III.Assessment	4	1.5	1	32.5	1.56	26	All
TOTAL	38	21.5	3	87.5	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 introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
- In practical sessions, the instructor will assist the students in applying theoretical concepts and results to the solving and modelling of problems in the field of mechanical engineering, 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.

CONTENTS

I. **Basic Concepts of Machines and Mechanisms**. Systems for production and fabrication. Elementary mechanisms. Determining loads. Stress, strain and deformation. Friction and wear.

II. **Bearings and Lubrication.** Bearings. Ball bearings. Lubrication.

III. **Kinematics and Dynamics of Mechanisms.** Kinematic study. Dynamic study. Flywheels. Synthesis of mechanisms. Spatial mechanisms.

IV. Mechanical Transmissions. Cogs. Gear wheels. Ordinary gear trains. Epicyclical (planetary) gear trains.
DESCRIPTION OF SKILLS
a. Basic knowledge of systems for production and fabrication.
b. Capacity to understand a basic knowledge of the theory of machines and mechanisms.
c. Ability to determine loads on the mechanical components of machines.
d. Ability to use the tools available for kinematic and dynamic analysis of each component.
e. Effective development of spoken and written communication.
f. Capacity for team work.
g. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Principles of Electric Machines and Circuits
Subject Area	Electrical Engineering
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 the skills worked on, individually or in group work, will be achieved by assigning an appropriate weighting to the following activities:

- Work submitted at intervals, either individual or group tasks.
- Reports on laboratory work
- 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				
I. Theoretical Studies	30		1	60	3.64	60.67	a; b; c; e
II. Practicals	10	15	0.5	30	2.22	37	b; c; d;
III. 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. Ability to learn independently.
h. Capacity for team work.

SUBJECT DESCRIPTION TABLE	
Subject Title	Automatic Regulation
Subject Area	Electronics and Automation
Module	Common Core for Industrial Subjects
Type	Compulsory
Number of ECTS credits	6
Scheduling	Fourth 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				
I. Theoretical Studies	32.0		2.0	34.0	2.72	45.33	a, b, c
II. Practicals		27.0	2.0	22.0	2.04	34.00	d, e, f, g, h, i, j
III. Assessment	4.0	2.0	1.0	24.0	1.24	20.67	All
TOTAL	36.0	29.0	5.0	80.0	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 session, 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. Fundamentals of electronics and their applications in mechanical engineering.
II. Industrial automation. Study of the field, control and monitoring levels
III. Control methods. Analysis of closed loop systems.
IV. Design and tuning of control systems. Study of proportional, proportional integral and proportional integral differential governors.
V. System analysis in the domain of frequency.
VI. Technologies for implementation: programmable logic controllers, programmable automation controllers, distributed control systems and computers

DESCRIPTION OF SKILLS
a. Knowledge of the fundamentals of electronics. b. Knowledge of the fundamentals of automata. c. Knowledge of the fundamentals of control methods. d. Capacity to understand and apply the principles of a basic knowledge of control engineering to la mechanical engineering. e. Capacity to design and tune control systems for mechanical processes. 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 new information and communication technologies (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. Capacity for team work.

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				
I.Theoretical Studies	20	5	0.5	35	2.42	40.33	a, c, e
II.Practicals	10	15	0.5	35	2.42	40.33	All
III.Assessment	3	5	1	20	1.16	19.33	All
TOTAL	33	25	2	90	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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 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	Graphic Design II
Subject Area	Graphic Design
Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Second semester
Prerequisites	None

METHOD OF ASSESSMENT

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

- Work submitted at intervals.
- 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				
I.Theoretical Studies	10	18	0.5	46	3	50	All
II.Practicals	6	21	0.5	22	2	33.3	All
III.Assessment	4	1	1	20	1	16.7	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. Drawing of installations in industrial premises and in buildings V. Computer-aided design

DESCRIPTION OF SKILLS
a. Knowledge of, and capacity to apply, the techniques of graphical engineering. b. Ability to represent systems in space. c. Ability to handle normalized representation and drawing of sets. 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 regulations g. Graphic resolution, alternative to analytic, of problems concerning installation projects. h. Use of CAD applications to produce normalized plans.

SUBJECT DESCRIPTION TABLE	
Subject Title	Industrial and Building Installations I
Subject Area	Physics
Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Seventh semester
Prerequisites	

METHOD OF ASSESSMENT
Assessment of student work and the skills worked on, individually or in group work, will be achieved by assigning an appropriate weighting to the following activities: • Work submitted at intervals, either individual or group tasks (20%). • Written examination with theoretical and practical questions (80%).

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	20	2	1	28	2.04	34.00	a,b,c

II.Practicals	15	18	1	40	2.96	49.33	a,b,c,d,e
III.Assessment	4		1	20	1.00	16.67	All
TOTAL	39	20	3	88	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

In classroom theoretical and practical sessions the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples, together with methods for calculations and their applications to specific cases.

In S-type classroom sessions, instructors will provide exercises of appropriate complexity to solve, using current regulations and obligatory standards. Thereafter, these exercises will be completed, together with others of greater difficulty, by means of software produced by different brands in the sector, so as to develop projects in a realistic and up-to-date form.

Groups of four or five students will be formed to undertake practical work set for each of these groups. The instructor will clarify all questions arising during the completion of this work.

CONTENTS

Block 1.- Hydraulic motors.
Block 2.- Positive displacement pumps. Centrifugal pumps.
Block 3.-Installations for pumping liquid fuels.
Block 4.- Compressors, turbo compressors and fans.
Block 5.- Ventilation installations.
Block 6.- Compressed air.
Block 7.-Oleo-hydraulics.

DESCRIPTION OF SKILLS

a. Applied knowledge of the fundamentals of fluid mechanical systems and machines.
b. Ability to learn independently.
c. Capacity for team work.
d. Ability to produce measurements, calculations, assessments, valuations, expert reports, studies, dossiers, work plans and other similar work in the field of this subject.
e. Ability to handle specifications, regulations and obligatory standards in the field of this subject.

SUBJECT DESCRIPTION TABLE	
Subject Title	Industrial and Building Installations II
Subject Area	Physics
Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Eighth semester
Prerequisites	

METHOD OF ASSESSMENT

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

- Work submitted at intervals, either individual or group tasks (20%).
- Written examination with theoretical and practical questions (80%).

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	20	2	1	28	2.04	34.00	a,b,c
II.Practicals	15	18	1	40	2.96	49.33	a,b,c,d,e
III.Assessment	4		1	20	1.00	16.67	All
TOTAL	39	20	3	88	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

In classroom theoretical and practical sessions the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples, together with methods for calculations and their applications to specific cases.

In S-type classroom sessions, instructors will provide exercises of appropriate complexity to solve, using current regulations and obligatory standards. Thereafter, these exercises will be completed, together with others of greater difficulty, by means of software produced by different brands in the sector, so as to develop projects in a realistic and up-to-date form.

Groups of four or five students will be formed to undertake practical work set for each of these groups. The instructor will clarify all questions arising during the completion of this work.

CONTENTS

Block 1.- Generation of thermal energy.
Block 2.- Distribution of thermal energy.
Block 3.-Installations for heating and preparation of air conditioning systems.
Block 4.-Solar-powered heating installations.
Block 5.-Air-conditioning installations.
Block 6.-Fire protection installations.
Block 7.- Industrial refrigeration.
Block 8.- Steam engineering.

DESCRIPTION OF SKILLS

a. Applied knowledge of heat engineering.
b. Ability to learn independently.
c. Capacity for team work.
d. Ability to produce measurements, calculations, assessments, valuations, expert reports, studies, dossiers, work plans and other similar work in the field of this subject.
e. Ability to handle specifications, regulations and obligatory standards in the field of this subject.

SUBJECT DESCRIPTION TABLE	
Subject Title	Theory of Structures I
Subject Area	Mechanics of Continuous Media and Theory of Structures
Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6

Scheduling	Fifth semester
Prerequisites	Resistance of Materials I and II

METHOD OF ASSESSMENT

Exercises and skills worked on individually and in group-work, whether or not carried out under the supervision of an instructor, will be assessed. There will be tests at the end of each block of instruction.

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	30		2	24	2.25	37.50	All
2. Practicals		30	2	24	2.25	37.50	All
3. Assessment	5	0	2	31	1.50	25.00	All
TOTAL	35	30	6	79	6	100	

All teaching and learning activities with the instructor will involve attendance by students at timetabled sessions.

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, instructors 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.

CONTENTS

I. Calculation process.
II. Calculations for articulated structures.
III. Calculations for structures with rigid nodes.
IV. Arches.
V. Lines of influence.

DESCRIPTION OF SKILLS

a. Knowledge and capacity to apply the fundamentals of elasticity and resistance of materials to the behaviour of real solids.
b. Knowledge and capacity to calculate and design industrial structures and constructions.
c. Calculation of the stresses and strains in any section of a structure and of the movements at points of the structure
d. Capacity to analyse and solve problems.
e. Ability to interpret results.

SUBJECT DESCRIPTION TABLE

Subject Title	Theory of Structures II
Subject Area	Mechanics of Continuous Media and Theory of Structures

Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Sixth semester
Prerequisites	Resistance of Materials I and II and Theory of Structures I

METHOD OF ASSESSMENT

Exercises and skills worked on individually and in group-work, whether or not carried out under the supervision of an instructor, will be assessed. There will be tests at the end of each block of instruction.

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	30		2	24	2.25	37.50	All
2. Practicals		30	2	24	2.25	37.50	All
3. Assessment	5	0	2	31	1.50	25.00	All
TOTAL	35	30	6	79	6	100	

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

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

CONTENTS

I. Theory of the matrix calculation of structures.
II. Solution of problems by means of computer programs.
III. Finite element method.
IV. Solution of problems by means of the finite element method.

DESCRIPTION OF SKILLS

a. Knowledge and capacities to apply the fundamentals of elasticity and resistance of materials to the behaviour of real solids.
b. Knowledge and capacity to calculate and design industrial structures and buildings.
c. Capacity to analyse and solve problems.
d. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Design of Machines
Subject Area	Mechanical and Fabrication Engineering

Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Eighth semester
Prerequisites	Theory of Machines and Mechanisms

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				
I.Theoretical Studies	30		1	40	2.84	47.33	a,b,c,f
II.Practicals	4	20	1	15	1.6	26.67	c,d,e,f
III.Assessment	4	1.5	1	32.5	1.56	26	All
TOTAL	38	21.5	3	87.5	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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

- 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 practical sessions, instructors will guide the students in the application of theoretical concepts and results for the solution and modelling of problems in the field of mechanical engineering, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for solving problems.

CONTENTS

I. **Introduction to the Designing and Calculating of Machines.** Fundamentals of the design and calculation of machines. Materials used in the construction of machines. Standards for the construction of machines. Testing machines.

II. **Designing for Different Type of Load.** Analysis of the resistance of components. Concentration of load. Mechanical study of fractures. Analysis of fatigue in components. Cumulative damage from fatigue.

III. **Calculation of Mechanical Parts.** Design and calculation of axles and shafts. Design of threaded parts and fixtures. Couplings. Clutches and brakes. Flexible mechanical transmissions.

DESCRIPTION OF SKILLS
a. Capacity to understand the basic concepts for calculating, designing and testing machines.
b. Ability to recognize the parts most frequently used in the construction of machines.
c. Capacity to produce projects for machines by integrating the various component parts studied.
d. Effective development of spoken and written communication.
e. Capacity for team work.
f. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Fabrication Engineering
Subject Area	Mechanical and Fabrication Engineering
Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Fifth 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				
I. Theoretical Studies	30		0.5	40	2.82	47	a,b,f
II. Practicals		24	1	15	1.6	26.67	b,c,d,e
III. 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 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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

- 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, instructors will guide the students in the application of

theoretical concepts and results for resolving problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.

- In practical sessions in the workshop and laboratory, the instructor will assist the students to gain a knowledge of safety and behaviour standards and of the use of the basic equipment and instruments of a shaping and welding workshop. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

CONTENTS

I. Forming by moulding. Classification of the processes of shaping by moulding. Sand moulding. Lost wax casting. Die casting. Distribution systems. Defects in cast pieces.

II. Forming by plastic deformation. Fundamentals of shaping by plastic deformation. Drawing process. Extrusion processes. Lamination processes. Forging processes.

III. Shaping by welding. Classification of welding processes. Standards. Automated welding.

IV. Transformation of plastics. Introduction to plastics. Injection of plastics. Extrusion of plastics. Other processes for transforming plastics.

V. Shaping compound materials. Types of compound materials. Principal shaping processes.

VI. Shaping ceramic materials and glass.

DESCRIPTION OF SKILLS

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

b. Knowledge and capacity to apply materials engineering.

c. Effective development of spoken and written communication.

d. Ability to learn independently.

e. Capacity for team work.

f. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Mechanical Technology
Subject Area	Mechanical and Fabrication Engineering
Module	Specific Technology (Mechanical Engineering)
Type	Compulsory
Number of ECTS credits	6
Scheduling	Fifth 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				
I.	Theoretical Studies	30		0.5	40	2.82	47	a,b,c,g
II.	Practicals		24	1	15	1.6	26.67	b,c,d,e,f
III.	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 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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

- 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, instructors will guide the students in the application of theoretical concepts and results for resolving problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.
- In practical sessions in the workshop and laboratory, the instructor will assist the students to gain a knowledge of safety and behaviour standards and of the use of the basic equipment and instruments of a machining workshop and a metrology laboratory. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

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.

DESCRIPTION OF SKILLS

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

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

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

d. Effective development of spoken and written communication.

e. Ability to learn independently.

f. Capacity for team work.

g. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Numerical Methods in Mechanical Engineering
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 the skills worked on, individually or in group work, whether or not during attendance at timetabled sessions, will be achieved by assigning an appropriate weighting to the following activities:

- In-class written tests
- Work handed in, such as essays and exercises.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20			30	2	33.3	a, b, e, f
II. Practicals		36	0.5	60	3.86	64.3	a, c, d, e, f, g
III. Assessment	3		0.5		0.14	2.4	
TOTAL	23	36	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 50 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

- Numerical methods for differential and partial differential equations with boundary conditions.
- Introduction to the finite element method.
- The finite element model for one-dimensional problems. Application to problems in engineering.
- The finite element model for two-dimensional problems. Application to problems in engineering.
- The finite element model for three-dimensional problems. Application to problems in engineering.

DESCRIPTION OF SKILLS

a. Ability to transmit information, ideas, problems and solutions in spoken or written form by means of mathematical language.
b. Capacity for team work, organizing, planning and distributing tasks among the various team members.
c. Capacity to cope with new situations involving the use of new knowledge and mathematical techniques, hence enhancing independent learning.

d. Capacity to analyse and build up mathematical models applied to mechanical engineering and especially those based on differential methods.
e. Understanding and mastery of the various methods for approximate solution of problems in mechanical engineering and skill in the use of appropriate computer tools.
f. Ability to use correctly computer applications for numerical calculations in order to experiment with and simulate problems related to the subject area.

SUBJECT DESCRIPTION TABLE	
Subject Title	Mechanics
Subject Area	Physics
Module	Specific to ULE
Type	Compulsory
Number of ECTS credits	6
Scheduling	Third Semester
Prerequisites	

METHOD OF ASSESSMENT

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

- Work submitted at intervals, either individual or group tasks
- Reports on activities.
- Written examination with theoretical and practical questions

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	26		1	40	2.68	44.7	a,b,c,d
2. Practicals	9	20	1	28	2.32	38.7	All
3. Assessment	4		1	20	1	16.6	All
TOTAL	39	20	3	88	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

In S-type sessions in the classroom, instructors 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 working sessions will be undertaken in the laboratory. In such sessions, the instructor will assist the students to gain a knowledge of safety and behaviour standards and of the use of various instruments.

CONTENTS
I. Two-dimensional dynamics of rigid bodies. Energy and amount of movement. II. Three-dimensional kinematics and dynamics of rigid bodies. III. Dynamics of deformable systems.
DESCRIPTION OF SKILLS
a. Ability to predict through calculations the behaviour of components and systems in which there are forces and movements. b. Capacity to grasp the formalism of the general theory of dynamic systems. c. Capacity to perform and interpret calculations for the experiments and problems undertaken. d. Ability to learn independently. e. Capacity for team work.

SUBJECT DESCRIPTION TABLE	
Subject Title	Acoustics and Vibration
Subject Area	Physics
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Continuous Assessment: The skills developed individually and students' capacity to work and co-ordinate themselves in groups, while supervised and led by the instructor, will be assessed.
The final mark will be determined from:

- Activities carried out throughout the course by students in class and their ability to find solutions for the work set.
- Marks obtained in tests and in public presentations throughout the course.
- The overall mark for students' contributions to group 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				
1. Theoretical Studies	18	-	1	30	1.96	32.67	a,
2. Practicals	18	15	0.5	60	3.74	62.33	b, c
3. Assessment	4	3	0.5	-	0.30	5	All
TOTAL	40	18	2	90	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, group chat sessions, forums and contacts through a virtual classroom.

In classroom theoretical sessions the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples, with the active participation of the group of students.

In S-type sessions, groups will be set up in which the instructor will orient the students in the application of theoretical concepts and results so that they can solve and model problems, producing reports in the area of engineering. At all times critical thinking and the exchange of information between working groups will be encouraged. The results obtained will have to be presented and explained in public with the participation of all the students.

CONTENTS

I. The nature of sound.
II. Propagation of sound outside buildings.
III. Acoustic instruments and measurements of noise.
IV. Drawing up noise charts.
V. Control of noise. Absorption and soundproofing.
VI. Noise in the workplace.
VII. Mechanical vibrations.

DESCRIPTION OF SKILLS

a. Applied knowledge of industrial noise, propagation, attenuation, absorption and soundproofing. Ability to solve problems related to the control of noise and vibrations. Noise and vibration in the workplace.
b. Ability of students to apply their knowledge to their work or vocation in a professional manner, to demonstrate their skills by formulating and arguing in favour of given viewpoints and to solve problems within their field of study.
c. Ability to transmit information, ideas, problems and solutions for matters typical of engineering

SUBJECT DESCRIPTION TABLE	
Subject Title	Refrigeration Engineering
Subject Area	Physics
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in 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				
1. Theoretical Studies	30		1	60	3.64	60.66	a,c,d,e,f,g,h,i,j
2. Practicals	8	15	0.5	30	2.14	35.67	a,b,c,d,e,f,g,h,i,j
3. Assessment	4	1	0.5		0.22	3.67	All
TOTAL	42	16	2	90	6	100	

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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

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 tools needed for installing and dismantling refrigeration equipment and the use of instruments for designing, calculating and maintaining refrigeration installations on the basis of an analysis of the operating parameters for the refrigeration systems studied. 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

I. Introduction to refrigeration.
II. Refrigerants.
III. Production of cold by simple compression.
IV. Compressors.
V. Evaporators.
VI. Condensers and heat recovery towers.
VII. Regulation and control of refrigerating systems.
VIII. Design of the refrigerant distribution network.
IX. Systems for refrigeration by multiple compression.
X. Absorption machines.
XI. Design of cold rooms.
XII. Calculation of the heat balance.
XIII. Industrial applications of cold.
XIV. Designing and commissioning a refrigeration circuit.
XV. Maintenance of refrigeration installations. Simulation.

DESCRIPTION OF SKILLS

a. Applied knowledge of systems for producing cold and the mechanisms for transmission of heat such that it can be applied to the design of equipment for heat transfer, the calculating of thermal loads and the design of machines based on mechanical compression and absorption. Ability to design, to calculate and to maintain refrigeration installations.
b. Ability to set up equipment and carry out practical laboratory experiments.
c. Understanding of knowledge in the area of refrigeration engineering based on higher-level textbooks, including certain aspects that imply knowledge gained from the cutting edge of the industrial sector.
d. Ability to learn independently.
e. Capacity to work alone or as part of a team.
f. Capacity to analyse and solve problems.
g. Capacity to perform and interpret calculations for the experiments undertaken.
h. Interpretation of sets of relevant data so as to express opinions including thoughts about appropriate topics of a scientific nature.
i. Ability to present work in a clear and attractive way.
j. Preparing arguments and making a case for them and solving problems in refrigeration engineering by applying the knowledge acquired in a reasoned and professional manner.

k. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
l. Ability to undertake further study in refrigeration engineering with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Multiphase Systems and Electric Machines
Subject Area	Electrical Engineering
Module	Specific to ULE
Type	Compulsory
Number of ECTS credits	6
Scheduling	Fifth semester
Prerequisites	Successful completion of the course in Industrial Electricity.

METHOD OF ASSESSMENT

Assessment of student work and the skills worked on, individually or in group work, whether or not during timetabled sessions, will be achieved by assigning an appropriate weighting to the following activities:

- In-class tests

and, where appropriate,

- Work submitted
- 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				
1. Theoretical Studies	29		1	30	2.40	40	a, b, c, d, e, g
2. Practicals	10	15		30	2.20	36.67	a, b, c, d, e, f, g, h
3. Assessment	4		1	30	1.4	23.33	a, b, c, d, e, g
TOTAL	43	15	2	90	6	100	

Approximately 95% of student work with an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

In S-type sessions in the classroom, instructors 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 working sessions will be undertaken in the laboratory. In such sessions, the instructor will assist the students to gain a knowledge of safety and behaviour standards and of the use of various instruments.

CONTENTS	
I.	Balanced and unbalanced three-phase systems.
II.	Transformers.
III.	Direct-current motors and generators. Characteristics.
IV.	Asynchronous electric machines. Motors and generators.
V.	Synchronous electric machines. Motors and generators.

DESCRIPTION OF SKILLS	
a.	Basic knowledge of electric networks
b.	Knowledge of the different types of electric machine, their make-up, specific operating principles and main characteristics.
c.	Understanding of the general applications of the various types of machines as a function of their specific characteristics.
d.	Awareness of the various tests to be made of machines in order to improve their characteristics.
e.	Applied knowledge of electrical technology in the field of mechanical engineering.
f.	Capacity to perform and interpret calculations for the experiments and problems undertaken.
g.	Ability to learn independently.
h.	Capacity for team work.

SUBJECT DESCRIPTION TABLE	
Subject Title	Industrial Electricity
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 set and skills worked upon individually or in groups, whether done with or without an instructor, will be assessed.
Work undertaken by students throughout the course will account for 20% of the final mark.
Marks from tests will account for 60%.
Attendance at practicals (field and laboratory work) and the submission of reports on practicals will account for 20%.

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
III.Assessment	3	3	0.5	0	0.26	4.34	All
TOTAL	33	27	2	88	6	100	

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.

Initially, 90% of student work with instructors will require attendance at timetabled slots. The remainder

will be by means of tools for distance learning. These proportions will vary as a function of the tools available.

In S-type working sessions, instructors will guide the students in the application of theoretical concepts and results for the resolution and modelling of problems in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups.

CONTENTS

I. Energy and power in electric systems.
II. Measurement, compensation and transport of electric energy.
III. Mechanical calculations for overhead electric cables.
IV. Lighting.
V. Electric installations and protection.

DESCRIPTION OF SKILLS

a. Ability to calculate, fix dimensions for, and measure power and electric energy in any of its forms, active, reactive or other.
b. Capacity to understand the concepts of reactive power compensation, procedures, resources, and similar.
c. Ability to understand, to set the size for, to calculate and to produce plans for overhead electric cables to transport energy.
d. Capacity to interpret, understand and apply all diagrams related to lighting. Definitions, uses, types of lamps.
e. Capacity to produce lighting projects for indoor and outdoor use.
f. Capacity to understand, size and draw up plans for low-voltage electric installations, as well as fixing dimensions for and co-ordinating appropriate protection.
g. Capacity to handle regulations for low voltage equipment and obligatory standards.

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 undertaken during timetabled sessions, will be achieved by assigning an appropriate weighting to the following activities:

- Work submitted at intervals, either individual or group tasks.
- 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				
I.Theoretical Studies	24		0.2	20	1.77	29.5	a, b

II.Practicals	10	16	0.6	40	2.66	44.33	b, c, d
III.Assessment	9		0.2	30	1.57	26.17	All
TOTAL	43	16	1	90	6	100	

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

CONTENTS

I. Technical vocabulary for mechanical engineers. Acronyms and abbreviations. Word formation: conversion, affixation and compounds. Collocations.
II. Grammar and use of language in technical discourse. Technical discourse-grammatical relationships.
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 relationship.
V. Professional communication in technical environments: reports, abstracts, articles, case studies, manuals, oral presentations, memos, CVs and application letters, face-to-face interactions, phone calls, on-line communications.

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 mechanical engineering.
b. Ability to gain the skills needed for drawing up and handling specifications, reports and similar documents in English.
c. Ability to communicate and transmit knowledge, abilities, skills and versatility in the area of mechanical engineering that will 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	Electronic Measurements and Instruments
Subject Area	Electronics
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	

METHOD OF ASSESSMENT

Continuous assessment will be used, taking into account the following aspects: mastery of theoretical and operational knowledge of the subject; attendance and participation in debates and individual or group work; completion of work set and case studies; 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				

I.Theoretical Studies	26		0.5	40	2.66	44.3	a, b, d, e
II.Practicals	23	7.5	0.25	40	2.83	47.2	a, b, c, d, e, f
III.Assessment	2		0.75	10	0.51	8.5	All
TOTAL	51	7.5	1.5	90	6	100	

All student work with instructors will involve attendance at scheduled sessions

Students will follow guidelines given by the instructor in respect of study, reading of texts and preparation of materials in advance of each theoretical or practical session, these to be done during their working hours without an instructor.

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, instructors 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.

In practical sessions in the laboratory, the instructor will guide the students in independent work, in gaining a knowledge of safety and behaviour standards and in the use of the tools and equipment in the laboratory. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

CONTENTS

I. Basic knowledge of instrumentation
II. Estimation of uncertainty, calibration and verification
III. Transducers, sensors, signal treatment and processing
IV. Processing and displaying results

DESCRIPTION OF SKILLS

a. Basic knowledge of instrumentation, transducers, sensors, signal processing and treatment, data display and error estimation.
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. Ability to learn independently.
f. Ability to work in a team, organizing and planning with an emphasis of quality, 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	Metrology and Quality Control
Subject Area	Mechanical and Fabrication Engineering
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Continuous Assessment: All the activities undertaken and skills 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				
I. Theoretical Studies	30		0.5	40	2.82	47	a, c, e
II. Practicals		24	1	15	1.6	26.67	a, b, d, e
III. 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 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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

- 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, instructors will guide the students in the application of theoretical concepts and results for resolving problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.
- In practical sessions in the workshop and laboratory, the instructor will assist the students in gaining a knowledge of the equipment, instruments and techniques used in a metrology laboratory. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

CONTENTS

I. Quality of measurements in industry. The field of dimensional metrology. Precision in industry. Assessment of measurement quality. Tools and techniques for evaluating quality and their costs.

II. Study, analysis and evaluation of tolerances. The chain of tolerances. Optimization of tolerances.

III. Metrology. Metrological techniques and systems. Legal and industrial metrology.

IV. Calibration. Organization of metrology. Uncertainty in measurements. Traceability and dissemination. Calibration plan.

V. Statistical checking of processes. Graphs for control by variables. Graphs for control by attributes. Machine and process capacity.

DESCRIPTION OF SKILLS

a. Capacity to understand the process of calibration and its application to a quality management system.

b. Knowledge of quality control techniques based on attributes and variables and their applications in calculating tolerances.

c. Effective development of spoken and written communication.

d. Ability to learn independently.

e. Capacity for team work.

f. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Process Planning
Subject Area	Mechanical and Fabrication Engineering
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Mechanical Technology and Fabrication Engineering

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				
I. Theoretical Studies	30		0.5	40	2.82	47	a,e
II. Practicals		24	1	15	1.6	26.67	a,b,c,d,e
III. 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 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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

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

awareness of the equipment and instruments used in a shaping workshop. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

CONTENTS

I. Introduction to the planning of production. Planning demand and the master plan. Planning requirements for materials and manufacturing resources.

II. Identification and selection of shaping processes. Limitations and opportunities. Associated costs.

III. Identification of machines. Sequencing machine operations. Routing sheets. Time scheduling.

IV. Design and selection of tools and equipment. Management of tools and equipment.

V. Setting operating conditions in accordance with technical and financial criteria.

VI. Planning the inspection process.

DESCRIPTION OF SKILLS

a. Capacity to design and prepare plans for a production process: choice of processes, machines, operations and their sequence, programs, tools and equipment.

b. Effective development of spoken and written communication.

c. Ability to learn independently.

d. Capacity for team work.

e. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Advanced Fabrication Processes
Subject Area	Mechanical and Fabrication 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:

- 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				
I. Theoretical Studies	30		0.5	40	2.82	47	a,b,f
II. Practicals		24	1	15	1.6	26.67	a,b,c,d,e

III. 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 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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

- 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, instructors will guide the students in the application of theoretical concepts and results for resolving problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.
- In practical sessions in the workshop and laboratory, the instructor will guide the students to an awareness of the equipment and instruments used in the advanced machining processes described. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

CONTENTS

I. Electrical discharge machining.

II. Electro-chemical machining.

III. Laser machining and welding.

IV. Other processes for machining and welding: ultrasound, ion beam, electron beam, water jet, plasma.

V. The latest developments in machining processes: micro- and nano-fabrication.

DESCRIPTION OF SKILLS

a. Knowledge of the fundamentals of advanced fabrication processes.

b. Basic knowledge of nanotechnology applied to the manufacture of mechanical systems.

c. Applied knowledge of welding techniques.

d. Effective development of spoken and written communication.

e. Ability to learn independently.

f. Capacity for team work.

g. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Integrated Manufacturing
Subject Area	Mechanical and Fabrication Engineering
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6

Scheduling	Sixth, seventh or eighth semester
Prerequisites	Knowledge of mechanical technology and fabrication engineering

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,f
2. Practicals		24	1	15	1.6	26.67	All
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 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 an instructor will involve attendance at timetabled sessions. The remainder, especially tutorials, may be carried out by means of tools for long-distance communication, to the extent that such tools improve and become more widespread.

- 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, instructors will guide the students in the application of theoretical concepts and results for resolving problems, at all times encouraging critical thinking. Exercises will be provided for the students to solve, thus acquiring skill in the use of the tools necessary for resolving problems.
- In practical sessions in the workshop and laboratory, the instructor will guide the students to an awareness of the equipment and instruments used in industrial plants to link pieces of equipment one with another. Students will perform simple experiments complementing and exemplifying the points covered in classroom sessions.

CONTENTS

I. Introduction to the development cycle for a product. Concurrent engineering. Systems for managing product and process data.

II. Introduction to manufacturing systems run by computer.

III. Computer-aided techniques in manufacturing: computer-aided design, design techniques, computer-aided engineering, prototyping techniques, computer-aided process planning, computer-aided manufacturing, computer-aided integration.

IV. Numeric control and programmable logic controllers. Types and technologies. Programming.

V. Systems for automated storage and handling of materials in a factory. Types, choice and design.

VI.	Robot systems in industrial establishments. Types, selection and programming.
VII.	Systems and cells for flexible manufacturing. Configurations and designs. Control techniques.
VIII.	Computer control of manufacturing systems. Signal acquisition in the factory.

DESCRIPTION OF SKILLS

a. Capacity to recognize and use information managed by computer applied to the production process: computer-aided design, computer-aided manufacturing, computer integrated manufacturing.

b. Capacity to use and program programmable logic controllers, computer numeric control and process control instrumentation in integrated manufacturing processes.

c. Effective development of spoken and written communication.

d. Ability to learn independently.

e. Capacity for team work.

f. Capacity to analyse and solve problems.

SUBJECT DESCRIPTION TABLE

Subject Title	Study of Elastoplasticity in Forming Processes
Subject Area	Mechanics of Continuous Media and Theory of Structures
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Physics, Mathematics, Resistance of Materials I and II.

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	30		2	24	2.25	37.50	All
2. Practicals		30	2	24	2.25	37.50	All
3. Assessment	9	0	2	27	1.50	25.00	All
TOTAL	39	30	6	75	6	100	

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

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

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

In laboratory practicals, theoretical solutions will be checked against those really obtained.

CONTENTS

I. Basic concepts of elasticity: tension strains and deformation strains.
II. Laws of elastic behaviour.
III. Plasticization criteria.
IV. Plasticity. The law of elastoplasticity.
V. Tensions produced by a combination of forces in an inelastic mode.
VI. Study of the formation of shavings in metal cutting
VII. Mechanical behaviour of materials at high speeds of deformation
VIII. Models of the process of cutting metals

DESCRIPTION OF SKILLS

a. Knowledge and use of the theory of elastoplasticity.
b. Capacity to analyse and solve problems.
c. Ability to interpret results.
d. Capacity to apply the theory of elastoplasticity to shaping processes
e. Capacity to understand the model of shavings formation in cutting metals
f. Capacity to understand the behaviour of materials at high speeds of deformation and at high temperatures
g. Capacity to apply the various models of shavings formation

SUBJECT DESCRIPTION TABLE	
Subject Title	Concrete Structures
Subject Area	Mechanics of Continuous Media and Theory of Structures
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Resistance of Materials I and II and Theory of Structures I and II

METHOD OF ASSESSMENT

The activities undertaken and skills worked upon, individually or in groups, whether done with or without an instructor, will be assessed.
At the end of the semester there will be an examination covering all the material in this subject.

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		2	24	2.25	37.50	All
II. Practicals		30	2	24	2.25	37.50	All
III. Assessment	5	0	2	31	1.50	25.00	All
TOTAL	35	30	6	79	6	100	

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

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

CONTENTS

I. Limit states and bases for calculation.
II. Materials. Standards.
III. Ultimate limit states: normal and tangential stresses and strains. Lateral flexing.
IV. Serviceability limit states: deformations, fissuring.
V. Parts of structures: girders, forgings, foundations, walls, plates and sheets.
VI. Quality control.
VII. Pathology.

DESCRIPTION OF SKILLS

a. Knowledge of concrete, both reinforced and pre-stressed, as a building material.
b. Knowledge of how to calculate reinforced and pre-stressed concrete structures for different strains and stresses.
c. Capacity to analyse and solve problems.
d. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Metal Structures
Subject Area	Mechanics of Continuous Media and Theory of Structures
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Resistance of Materials I and II, Theory of Structures I and II, and Study of Elastoplasticity in Forming Processes

METHOD OF ASSESSMENT

The activities undertaken and skills worked upon, individually or in groups, whether done with or

without an instructor, will be assessed.
At the end of the semester there will be an examination covering all the material in this subject.

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		2	24	2.25	37.50	All
2. Practicals		30	2	24	2.25	37.50	All
3. Assessment	5	0	2	31	1.50	25.00	All
TOTAL	35	30	6	79	6	100	

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

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

CONTENTS

I. Materials. Standards
II. Bases for calculations. Types of structures.
III. Calculations for parts of structures submitted to flexing, traction, compression and torsion. Linear and non-linear analysis
IV. Joints and links.
V. Quality control. Pathology.
VI. Industrial buildings.
VII. Mixed structures.

DESCRIPTION OF SKILLS

a. Knowledge of metal materials for industrial buildings.
b. Knowledge of calculations for the various stresses and strains affecting steel structures.
c. Capacity to analyse and solve problems.
d. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Ground Engineering
Subject Area	Mechanics of Continuous Media; Theory of Structures
Module	Specific to ULE
Type	Optional
Number of ECTS credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Resistance of Materials I and II; Theory of Structures I and II; Study of Elastoplasticity in Forming Processes

METHOD OF ASSESSMENT
The activities set and skills worked upon, individually or in groups, whether done with or without an instructor, will be assessed. At the end of the semester an examination will be held covering all the material in this subject.

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		2	24	2.25	37.50	All
2. Practicals		30	2	24	2.25	37.50	All
3. Assessment	5	0	2	31	1.50	25.00	All
TOTAL	35	30	6	79	6	100	

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

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

CONTENTS

I. Soils: types and properties.
II. Tensions. Compressibility and consolidation. Resistance to cutting.
III. Recognition of ground.
IV. Thrusts and excavations. Walls.
V. Shallow foundations: concrete foundation beams, slabs.
VI. Deep foundations: piling.
VII. Pathology. Underpinning. Ground improvement.

DESCRIPTION OF SKILLS

a. Knowledge of soil mechanics and its applications in building.
b. Knowledge and application of the various methods of providing foundations for structures.
c. Capacity to analyse and solve problems.
d. Ability to interpret results.

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 semesters
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 aerospace 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.