Access

University of Leon [ULE]

Graduate in Aerospace 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

- Sixty 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 Aeronautical Engineer, currently taught at the University of Leon.

- Over the last five years the average enrolment for that qualification was 60 students, the demand for places exceeding this number by approximately 20%.

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 Aeronautical Engineer. (As indicated in the *Boletín Oficial de Estado* [Spanish Official Gazette] of Wednesday 18 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

- Aerodynamics
- Aircraft Engines
- Propulsion
- Aerospace Technology
- Control Engineering
- Aeronautical Materials
- Aeronautical Structures
- Aerial Navigation
- Airports
- Air Transport

2 Teaching Plan

2.1 Structure of the Course

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

Module		ECTS
Basic Core [Core]		60
Common Core for Aeronautical Subjects		60
Specific Technology (Aircraft Engines)		48
Courses Specific to the University of Leon [ULE]	Compulsory Subjects (Technologies Specific to the Field of Aeronautics) [Comp]	24
	Optional Subjects (Other Specific Technologies) [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 Aeronautical Subjects			
Subject Area	ECTS	Skills	Type
Physics	12	• Adequate knowledge, applied to engineering, of the fundamentals of fluid mechanics. • Applied knowledge of fluid mechanics. • Understanding of the thermodynamic cycles generating mechanical power and thrust. • Applied knowledge of thermodynamics • Adequate knowledge, applied to engineering, of the concepts and laws governing the processes of transfer of energy, the movement of fluids, the mechanisms for the transmission of heat and change of matter and their role in the analysis of the principal aerospace systems of propulsion	Comp
Aerospace Technology	6	• Applied knowledge of aerospace technology • Adequate knowledge, applied to engineering, of the basic components of the various types of aircraft.	Comp
Aerial Navigation	6	• Overall understanding of the system of aerial navigation and the complexity of air traffic. • Adequate knowledge, applied to engineering, of the functional elements of the system of aerial navigation and the associated electrical and electronic installations. • Applied knowledge of systems of aerial navigation and traffic.	Comp
Aerodynamics	6	• Understanding of how aerodynamic forces determine the dynamics of flight and the role of the several variables involved in the phenomenon of flight. • Applied knowledge of aerodynamics.	Comp
Mechanics of Continuous Media	6	• Adequate knowledge, applied to engineering, of: the principles of the mechanics of continuous media and the techniques for calculating their responses. • Understanding of the behaviour of structures faced with demands under operating conditions and in extreme. • Applied knowledge of mechanics and theory of structures.	Comp
Mechanical and Fabrication Engineering	6	• Understanding of the processes of fabrication • Adequate knowledge, applied to engineering, of the principal physical and mechanical characteristics and properties of materials. • Understanding of the technological features of materials, techniques for optimization of materials and the modification of their properties by means of treatments. • Applied knowledge of the science and technology of materials.	Comp
Airports and Air Transport	6	• Understanding of the unique features of the infrastructures, buildings and operation of airports. • Adequate knowledge, applied to engineering, of the fundamentals of the design and construction of airports and the various elements composing them. • Understanding of the system of air transport and its co-ordination with other means of transport. • Applied knowledge of air transport • Applied knowledge of environmental impact • Applied knowledge of economics and production.	Comp
Aircraft	6	• Adequate knowledge, applied to engineering, of the basic principles of control and automation of flight. • Applied knowledge of the mechanics of flight.	Comp
Projects	6	• Applied knowledge of projects.	Comp

Module: Specific Technology (Aircraft Engines)

Subject Area	ECTS	Skills	Type
Physics	6	• Adequate knowledge, applied to engineering, of the numerical simulation of the most significant physical and mathematical processes • Applied knowledge of mechanics and thermodynamics.	Comp
Chemistry	6	• Adequate knowledge, applied to engineering, of the fuels and lubricants used in aviation and automotive engines	Comp
Mechanics of Continuous Media	6	• Adequate knowledge, applied to engineering, of the mechanics of fracture of continuous media and the dynamic consideration of fatigue, of structural instability and of aero-elasticity	Comp
Aircraft Engines	24	• Adequate knowledge, applied to engineering, of the methods for calculating and developing the installation of propulsion systems; regulation and control of installations of propulsion systems; use of the experimental techniques, equipment and measuring instruments specific to the discipline; systems for maintenance and certification of aircraft engines. • Applied knowledge of the operation of aircraft, jets and rockets; engineering of propulsion systems.	Comp
Propulsion	6	• Applied knowledge of internal aerodynamics and the theory of propulsion.	Comp

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type
Graphic Design	6	• Ability to represent systems in space. • Ability to normalize representation and draw sets. • Ability to use tools for computer-aided graphic design for aerospace systems.	Comp
English	6	• Ability to operate satisfactorily in an English-speaking context, especially in technological departments outside Spain, enhancing the skills of oral and written comprehension in the English language. • Ability to compose technical reports, descriptions of processes, C.V.s and other specific documents relating to the general and technical management of research projects. • Knowledge of, and ability to use, specific terminology relating to the field of study such as to permit thorough understanding of the International Civil Aviation Organization and the functioning of the various modes of transport in the world transport system, with special emphasis on air transport.	Comp
Mechanics of Continuous Media	6	• Knowledge of aeronautical materials.	Comp
Aircraft	6	• Adequate knowledge, applied to engineering, of aircraft systems and systems for automatic control of the flight of air- and space-craft. • Adequate knowledge, applied to engineering, of the physical phenomena of flight, its qualities and control, aerodynamic and propulsion forces, operations and stability.	Comp

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type
	12	• Adequate knowledge, applied to engineering, of the methods for calculation of aeronautical designs and projects; simulation, design, analysis and interpretation of in-flight experiments and operation; systems for maintenance and certification of aircraft. • Applied knowledge of cosmography. • Applied knowledge of aircraft engineering (fixed- and rotary-wing). • Adequate knowledge, applied to engineering, of the use of aerodynamic experimentation and the most significant parameters in theoretical applications. • Adequate knowledge, applied to engineering, of the concepts and laws governing internal combustion and their application to rocket propulsion.	Opt
Physics	18	• Applied knowledge of meteorology. • Applied knowledge of the generation and propagation of sound, acoustic maps of airport infrastructures, the impact of noise contamination in the surroundings of airports, contamination indices, limits of tolerance and methods for noise control. Regulation of noise in commercial aviation. • Knowledge of vibrations. • Applied knowledge of hydraulics. • Adequate knowledge, applied to engineering, of the fundamentals of fluid mechanics describing flows in all circumstances, so as to determine the distribution of pressures and forces on aircraft.	Opt
Aerial Navigation	6	• Adequate knowledge, applied to engineering of the requirements of on-board and ground equipment for correct operation; in-flight operation of aerospace systems; planning , design and installing of systems to permit management of air traffic; methods for calculating and performing aerial navigation; calculations for specific systems for aerial navigation and their infrastructures; actions, manoeuvres and control of aircraft; applicable regulations; the functioning and management of air transport; systems for air navigation and air traffic; systems for aerial communication and observation. • Applied knowledge of: distribution, management and economics of air transport.	Opt
Environmental Studies	6	• Adequate knowledge, applied to engineering, of the fundamentals of sustainability, maintainability and operationality of systems for aerial navigation. • Adequate knowledge, applied to engineering, of the fundamentals of sustainability, maintainability and operationality of air- and space-craft and space systems. • Adequate knowledge, applied to engineering, of the environmental impact of infrastructures.	Opt
Airports and Air Transport	6	• Adequate knowledge, applied to engineering, of the materials used in building; the requirements and development of airport infrastructures and their environmental impact; the buildings necessary for the operation and functioning of airports. • Applied knowledge of building; airport installations; maintenance and running of airports; air transport. • Applied knowledge of cartography, topography and land studies. • Adequate knowledge, applied to engineering, of specific regulations for buildings; procedures for control and execution of works; functioning and management of airports and air transport. • Adequate knowledge, applied to engineering, of methods for calculating and developing the various solutions for buildings and paving in airports; calculations for the specific systems in airports and their infrastructures; evaluation of the technical and financial performance of aircraft; use of the experimental techniques, equipment and measuring instruments appropriate to the discipline; plans for safety and control in airports.	Opt

Module: Specific to ULE			
Subject Area	ECTS	Skills	Type
Aerospace Equipment and Materials	12	• Adequate knowledge, applied to engineering, of the techniques for inspection, quality control and fault detection; the most appropriate methods and techniques for repairs; the physical phenomena of flight of air defence systems, their characteristics and how they are controlled, their actions, stability and automatic control systems; methods for calculating and developing defence materials and systems; the technological performance and techniques for optimization of the materials used in the aerospace sector and the treatments and processes for modifying their mechanical properties. • Applied knowledge of engineering for air defence (ballistics, missiles and air systems) and the propulsion of space-craft.	Opt
Electrical Technology	6	• Applied knowledge of electricity and electrical technology. • Adequate knowledge, applied to engineering, of electrical installations. • Applied knowledge of electrical installations in the ground and air sectors.	Opt
Electronics	6	• Adequate knowledge, applied to engineering, of electronic installations. • Applied knowledge of electronics. • Applied knowledge of transmitters and receivers; transmission lines and systems broadcasting signals for aerial navigation.	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 Aerospace 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 in Mechanical Engineering
- Graduate in Computer Engineering
- Graduate in Engineering in Industrial Electronics and Automation

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
		Further Physics	6	
Chemistry	6	Chemistry	6	Core
Graphic Design	6	Graphic Design I	6	Core
Computing	6	Computing	6	Core
Business Studies	6	Organization of Aerospace Companies	6	Core

Module: Common Core for Aeronautical Subjects				
Subject Area	ECTS	Subjects	ECTS	Type
Physics	12	Fluid Mechanics	6	Comp
		Applied Thermodynamics	6	
Aerospace Technology	6	Aerospace Technology	6	Comp
Aerial Navigation	6	Aerial Navigation	6	Comp
Aerodynamics	6	Aerodynamics	6	Comp
Mechanics of Continuous Media	6	Theory of Structures	6	Comp
Mechanical Engineering and Fabrication	6	Manufacturing Processes	6	Comp
Airports and Air Transport	6	Airports	6	Comp
Aircraft	6	Control Systems	6	Comp
Projects	6	Project Management	6	Comp

Module: Specific Technology (Aircraft Engines)				
Subject Area	ECTS	Subjects	ECTS	Type
Physics	6	Numerical Simulations in Aerospace Engineering	6	Comp
Chemistry	6	Fuels and Lubricants	6	Comp

Mechanics of Continuous Media	6	Aero-elasticity	6	Comp
Aircraft Engines	24	Jet Engines	6	Comp
		Turbojets and Propellers	6	
		Aircraft Engine Assemblies	6	
		Reciprocating Engines	6	
Propulsion	6	Propulsion	6	Comp

Module: Specific to ULE				
Subject Area	ECTS	Subjects	ECTS	Type
Graphic Design	6	Graphic Design II	6	Comp
English	6	English	6	Comp
Mechanics of Continuous Media	6	Materials Engineering	6	Comp
Aircraft	18	Mechanics of Flight	6	Comp
		Aircraft Calculations	6	Opt
		Satellites	6	
Physics	18	Hydraulics	6	Opt
		Aeronautical Meteorology	6	
		Noise and Vibrations	6	
Aerial Navigation	6	Air Traffic Control	6	Opt
Environmental Studies	6	Aerospace Sustainability	6	Opt
Airports and Air Transport	6	Airport Engineering: Airport Buildings and Installations	6	Opt
Aerospace Equipment and Material	12	Materials and Maintenance for Aeronautical Systems	6	Opt
		Rockets and Missiles	6	
Electrical Technology	6	General Electrical Technology	6	Opt
Electronics	6	Electronics in Communications and Navigation Systems	6	Opt

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

2.4 Scheduling of Subjects

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

First Year			
First Semester		**Second Semester**	
Subject	**ECTS**	**Subject**	**ECTS**
Linear Algebra and Geometry	6	Numerical and Statistical Methods	6
Differential and Integral Calculus	6	Further Physics	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**
Fluid Mechanics	6	Fuels and Lubricants	6
Aerospace Technology	6	Materials Engineering	6
Mathematical Methods in Engineering	6	Aerodynamics	6
Organization of Aerospace Enterprises	6	Aerial Navigation	6
Applied Thermodynamics	6	Propulsion	6
TOTAL	30	**TOTAL**	30

Third Year			
Fifth Semester		**Sixth Semester**	
Subject	**ECTS**	**Subject**	**ECTS**
Theory of Structures	6	Control Systems	6

Reciprocating Engines	6	Airports	6
Manufacturing Processes	6	Turbojets and Propellers	6
Jet Engines	6	Option 1	6
Mechanics of Flight	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
Numerical Simulations in Aerospace Engineering	6	Aero-elasticity	6
Project Management	6	Aircraft Engine Assemblies	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
Université Bordeaux I	France
Université Evry Val d'Essonne	France
Université Paul Sabatier-Toulouse III	France
Università degli Studi di Bolonia	Italy
Università degli Studi di Napoli Federico II	Italy
Politechnika Warszawska	Poland
Universidade da Beira Interior	Portugal
Universidade Tecnica de Lisboa	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 of 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 of 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

University	Country
Universidad Columbia del Paraguay	Paraguay
International University of Moscow	Russia
Voronezh State University	Russia
Gardner-Webb University	U.S.A.
Central Connecticut State University	U.S.A.
Michigan Technological University	U.S.A.
Northern Kentucky University	U.S.A.
Pitzer College	U.S.A.
University of New York at Stony Brook	U.S.A.
University of Central Arkansas	U.S.A.
University of Wisconsin Green Bay	U.S.A.
University of Vermont	U.S.A.

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

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

2.6 Detailed Description of the Subjects in the Syllabus

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

SUBJECT DESCRIPTION TABLE	
Subject Title	
Subject Area	
Type	Basic Core; Compulsory; Optional
Number of ECTS Credits	6
Scheduling	First Semester; Second Semester; .....
Prerequisites	*When subjects are specified in this section, it implies the following:* *1. Students are recommended to have acquired prior knowledge of these subjects.* *2. Students must currently be, or previously have*

	been, enrolled for these subjects

METHOD OF ASSESSMENT

TEACHING AND LEARNING ACTIVITIES							
Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies							
2. Practicals							
3. Assessments							
TOTAL							

C = Class (whole-group session) S = Seminar (part-group session) T = Tutorial (individual session)

Description of the teaching and learning activities

CONTENTS

DESCRIPTION OF SKILLS

SUBJECT DESCRIPTION TABLE	
Subject Title	Linear Algebra and Geometry
Subject Area	Mathematics
Module	Basic Core
Type	Basic Core
Number of ECTS Credits	6
Scheduling	First semester
Prerequisites	None

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

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

	C	S	T	Instructor			
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 75 students.

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

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

CONTENTS

I. Systems of linear equations. Matrices and determinants.

II. Vector spaces.

III. Diagonalization.

IV. Affine and Euclidean geometry.

V. Quadratics and conics.

DESCRIPTION OF SKILLS

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

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

(c) Ability 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. Assessments	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
II. Assessments	6		0.25		0.24	4	All
TOTAL	24	35.5	0.5	90	6	100	

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

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

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

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

CONTENTS

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

DESCRIPTION OF SKILLS

Transferrable:

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

b. Ability for critical thinking and self-critique.

Specific to the subject:

c. Ability to resolve mathematical problems arising in engineering.

d. Ability to apply a knowledge of: differential geometry; differential and partial differential equations.

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

METHOD OF ASSESSMENT

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

- In-class written tests.
- Work handed in.
- Oral presentations.
- Other complementary activities.

TEACHING AND LEARNING ACTIVITIES

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

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

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

Seminar sessions (S) comprise activities carried out in medium-sized groups of up to 25 students. As a function of the resources available to the University practical sessions with computer packages will be held.

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

CONTENTS

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

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

DESCRIPTION OF SKILLS

(a) Ability to solve the mathematical problems arising in engineering.

(b) Ability to apply a knowledge of numerical methods, numerical algorithms, statistics and

optimization.

(c) Ability to analyse and 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 (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	26		1	40	2.68	44.7	a, c, d
II. Practicals	9	20	1	28	2.32	38.7	a, b, c, d, e
III. 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.

CONTENTSS

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

METHOD OF ASSESSMENT

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

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	24	5	0.5	30	2.38	39.67	a, d
II. Practicals	6	20	0.5	30	2.26	37.67	all
II. Assessments	4	1	1	28	1.36	22.67	all
TOTAL	34	26	2	88	6	100	

All teaching and learning activities of types C and S with the instructor will involve attendance at timetabled sessions. 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 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 to a knowledge of the basic equipment of a physics laboratory and the use of instruments to carry out measurements, as also analysis of results. The students will carry out simple experiments to complement and exemplify the material covered in class sessions. In these experiments students will apply the tools for solving problems that they have acquired.

CONTENTS

I. Electric fields
II. Magnetic fields
III. Electromagnetic fields
IV. Electric circuits
V. Electromagnetic waves.
VI. Properties of waves

DESCRIPTION OF SKILLS

a. An understanding and mastery of the basic concepts of fields, waves and electromagnetism 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 on the basis of the experiments undertaken.
d. Ability to learn independently.
e. Ability to work in a group.

SUBJECT DESCRIPTION TABLE

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

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, whether individually and/or in groups, will be achieved by assigning appropriate weightings to the following activities:
- Work periodically submitted for assessment, whether done individually or in groups.
- Oral presentations.
- Reports on laboratory work.
- Examinations.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without 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.
e. 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	50.3	all
II. Practicals	6	21	0.5	22	2	32.6	all
III. Assessments	4	1	1	20	1	17.1	all
TOTAL	20	40	2	88	6	100	

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

CONTENTS

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

DESCRIPTION OF SKILLS

a. Capacity for spatial vision and knowledge of the techniques for graphical representation, both using the traditional methods of metric and descriptive geometry, and by means of computer-aided design applications.
b. Operational graphic capacity.
c. Acquiring theoretical and practical knowledge of normalization and the conventionalisms used and applied by engineering professionals in technical drawing.
d. Mastery of the readings needed for industrial graphical representations, such as to allow reconstruction in space of objects shown in projections.
e. 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				
I. Theoretical Studies	20		1.25	22	1.73	28.8	All
II. Practicals		35	1.25	44	3.21	53.5	All
III. 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	Organization of Aerospace Enterprises
Subject Area	Business Studies
Module	Basic Core
Type	Basic Core
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	None

METHOD OF ASSESSMENT

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

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

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	20	2	0.2	22	1.77	29.46	a, b, c
II. Practicals	10	20	0.3	40	2.81	46.86	a, b, c, d, e
II. Assessments	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. INTRODUCTORY ASPECTS

Topic 1: Introduction to aerospace enterprises. Institutional and legal context.
Topic 2: Business organization and management: functional areas
Topic 3: Managing business projects
Topic 4: The activity of advanced planning in an enterprise
Topic 5: Operational management

II. DESIGN OF THE SYSTEM OF PRODUCTION AND OPERATIONS

Topic 6: Product development
Topic 7: Design of the process of production
Topic 8: Capacity of the production system

Topic 9: Location of installations and lay-out of the plant
Topic 10: New trends in operational management

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

SUBJECT DESCRIPTION TABLE	
Subject Title	Fluid mechanics
Subject Area	Physics
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third Semester
Prerequisites	None

METHOD OF ASSESSMENT
Assessment of student work and the skills acquired, either individually or in 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	32		1	70	4.12	68.66	a,b,d,e,f,g,h,i
2. Practicals	14	7	0.5	20	1.66	27.67	a,b,c,d,e,f,g,h,i
3. Assessments	4	1	0.5		0.22	3.67	all
TOTAL	50	8	2	90	6	100	

Students will spend at least 5% of their time allocated to working without the instructor on preparation for classes, reading material from a list supplied in advance by the instructor.
Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be undertaken by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in the application of theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Exercises will be set for students to complete, thus acquiring skill in the use of the tools necessary for solving problems.
In practical sessions in the laboratory, the instructor will guide the students in the use of basic experimental techniques to develop in them the ability to assemble hydraulic circuits and handle apparatus, so that students can produce useful information about a phenomenon from experimental results as well as present that information in an appropriate fashion (use of non-dimensional parameters,

graphs and so forth.).
Students will carry out simple experiments to complement and exemplify the material covered in classes, for which they will apply the tools for the resolution of problems that they have acquired.

CONTENTS

I. Introduction and basic concepts.
II. Properties of fluids.
III. Pressure and statics of fluids.
IV. Kinematics of fluids.
V. Equations for the conservation of mass, Bernoulli and energy equations.
VI. Analysis of the quantity of movement in systems of flows.
VII. Dimensional analysis and modelling.
VIII. Flow in pipes.
IX. Differential analysis of flows of fluids.
X. Approximate solutions for Navier-Stokes equations.
XI. Flows over bodies: drag and lift.
XII. Compressible flows.
XIII. Flow in open channels.
XIV. Turbomachinery.

DESCRIPTION OF SKILLS

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

SUBJECT DESCRIPTION TABLE

Subject Title	Applied Thermodynamics
Subject Area	Physics
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third Semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, individually or in group work, will be achieved by consideration and weighting of the practical activities carried out, whether individually or in a group (20%), together with a final test on the theoretical and practical material covered (80%).

TEACHING AND LEARNING ACTIVITIES

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

	C	S	T	Instructor	S		
1.Theoretical Studies	30		1	60	3.64	60.7	a, b, c, d, e, f, g, i
2.Practicals		26		30	2.24	37.3	a, b, c, d, e, f, g, h
3.Assessments	3				0.12	2.0	all
TOTAL	33	26	1	90	6	100	

Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be undertaken by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the field, by means of theoretical explanations and illustrative examples.
In classroom practical sessions, the instructor will guide the students in the application of theoretical concepts and results to solving problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, thus acquiring skill in the use of the tools necessary for the resolution of problems.
In practical sessions in the laboratory, the instructor will guide the students to a knowledge of safety and behaviour standards, of the use of the basic equipment of a laboratory and the employment of instruments.
The practical applications of power and thrust cycles and their implications for aeronautics will be considered.
Student will perform simple experiments that complement and exemplify the materials covered in classes, for which they will apply the tools for the solving of problems that they have acquired.

CONTENTS

I. Fundamental concepts of thermodynamics
II. Thermodynamic properties of pure substances
III. First law of thermodynamics
IV. Second law of thermodynamics. Entropy.
V. Analysis of flow processes.
VI. Kinematics of fluids
VII. Exergetic analysis.
VIII. Thermodynamic cycles generating power.
IX. Thermodynamic cycles of gas turbines and propulsion.
X. Transmission of heat. Fundamental principles.
XI. Transmission of heat through conduction.
XII. Transmission of heat through convection
XIII. Transmission of heat through radiation

DESCRIPTION OF SKILLS

a. An understanding of thermodynamic cycles generating mechanical power and thrust.
b. Applied knowledge of thermodynamics
c. Adequate knowledge, applied to engineering, of the concepts and laws governing the processes of transfer of energy, movement of fluids, the mechanisms for the transmission of heat and changes in matter and their role in the analysis of the principal systems of aircraft propulsion.
d. Knowledge of applied thermodynamics and the transmission of heat.
e. Knowledge of basic principles and their application to solving problems in engineering.
f. Ability to gather and interpret relevant data so as to express opinions including reflections on appropriate topics of a social, scientific or ethical nature.
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
h. Capacity for team work.
i. Ability to undertake further study of applied thermodynamics with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Aerospace Technology
Subject Area	Aerospace Technology

Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Third semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test covering theory (40%) and practicals (60%). When this test has been successfully completed, a weighted average will be calculated, incorporating the mark for the personal portfolio that will cover all the field-work activities carried out during the course. The weightings will be 85/15 respectively.

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	60	3.6	60.0	a, b, c, d, e, f
2. Practicals	6	22		28	2.24	37.3	a, c, d, e, f
3. Assessments	4				0.16	2.7	all
TOTAL	39	22	1	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.
Students will spend at least un 5% of their working time without an instructor on preparation for classes, reading material from a list supplied in advance by the instructor.
In classroom theoretical sessions, the instructor will introduce the concepts, results and methods of the subject, using theoretical explanations and illustrative examples.
In S-type sessions in the classroom, the instructor will advise students on the application of theoretical concepts and results to resolving problems and modelling in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus acquiring skill in the use of the tools necessary for resolving problems.
The remaining working sessions of type S will take place in hangars and airports, in direct contact with professionals from the sector.

CONTENTS

I. History of aeronautics and space
II. Standard atmosphere, real atmosphere and basic meteorology
III. Fundamental concepts of fluid mechanics
IV. Aerodynamics of an aeroplane: profiles, wings and lift-boosting assemblies
V. Principles of the mechanics of flight
VI. Aircraft and their systems: structural components and aerospace materials
VII. Aircraft and their systems: hydraulic, pneumatic, fire prevention and fuel systems
VIII. Aircraft and their systems: electrical and on-board instrument systems
IX. Aircraft and their systems: ground systems
X. Propulsion systems based on reciprocating engines
XI. Propulsion systems based on jet and rocket motors
XII. Airports
XIII. Systems for assisting aerial navigation
XIV. Solar system. Kepler's laws and the space environment
XV. Spacecraft: missions, subsystems, launchers and ground stations

DESCRIPTION OF SKILLS

a. Applied knowledge of aerospace technology.
b. Adequate knowledge, applied to engineering, of the basic components of the various types of aircraft.

c. An understanding of information from the area of aerospace engineering derived from advanced textbooks, including aspects that involve knowledge obtained from the cutting edge of the aerospace sector
d. Formulating and arguing in favour of viewpoints and solving aerospace problems through the application of the knowledge acquired, in a reasoned and professional way.
e. Interpretation of relevant data sets so as to express opinions including reflections on appropriate topics of a social and scientific nature.
f. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
g. Ability to undertake further study of aerospace technologies with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Aerial Navigation
Subject Area	Aerial Navigation
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test covering both theory (40%) and practice (60%). When this test has been successfully completed, a weighted average will be calculated incorporating the mark for the personal portfolio which will include all the practical activities carried out during the course. The weightings will be 85/15 respectively.

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	60	3.6	60.0	all
2. Practicals	16	12		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	49	12	1	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.
Students will spend at least un 5% of their working time without an instructor on preparation for classes, reading material from a list supplied in advance by the instructor.
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 S-type classroom sessions the instructor will guide the students in the application of theoretical concepts and results to the solving of problems and their modelling in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus acquiring skill in the use of the tools necessary for resolving problems.
The rest of the S-type sessions will take place at airports, in hangars and workshops, en direct contact with professionals from the sector.

CONTENTS

I. Introduction to air traffic and navigation
II. Air traffic organizations

III. Management of air traffic and trunk routes
IV. Techniques for aerial navigation
V. Independent navigation systems: inertial
VI. Independent navigation systems: primary and secondary radar
VII. Independent navigation systems: radio altimeters
VIII. Ground-aided navigation systems: DME
IX. Ground-aided navigation systems: VOR
X. Ground-aided navigation systems: ILS
XI. Satellite-aided navigation systems: GPS, GLONASS and GALILEO
XII. Other older navigation systems
XIII. Configuration of a radio aid system
XIV. Criteria for locations
XV. Maintenance of aerial navigation systems

DESCRIPTION OF SKILLS

a. Overall understanding of the system of aerial navigation and the complexity of air traffic
b. Adequate knowledge, applied to engineering, of: the functional elements of the system of aerial navigation and the associated electrical and electronic installations
c. Applied knowledge of navigation systems and air traffic
d. An understanding of information in the field of aerial navigation drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector.
e. Formulating and arguing in favour of viewpoints and solving problems of aerial navigation through the application of the knowledge acquired, in a reasoned and professional way.
f. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social or scientific and technical nature.
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
h. Ability to undertake further study in the field of aerial navigation with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Aerodynamics
Subject Area	Aerodynamics
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test covering theoretical (40%) and practical aspects (60%). When this test has been successfully completed, a weighted average will be calculated incorporating the mark for the report on experimental practicals in the wind tunnel. The weightings will be 90/10 respectively.

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	60	3.6	60.0	a, b, d, e, f, g, h
2. Practicals	24	4		28	2.24	37.3	a, b, c, d, e, f, g, h
3. Assessments	4			0	0.16	2.7	all
TOTAL	57	4	1	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.
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.
In classroom theoretical sessions, the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and examples illustrating them.
In S-type sessions in the classroom, the instructor will assist the students in applying theoretical concepts and results to the resolution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, hence providing them with skills in the use of the tools necessary for resolving problems
The remaining S-type sessions will be carried out in the two-dimensional wind tunnel, under the supervision of the instructor.

CONTENTS

I. Introduction to aerodynamics and general equations
II. Potential uncompressible two-dimensional movement: theory
III. Potential uncompressible two-dimensional movement: aerodynamic profiles
IV. Potential uncompressible two-dimensional movement: conformal transformation
V. Potential uncompressible two-dimensional movement: linearization for thin profiles
VI. Potential uncompressible three-dimensional movement: theory
VII. Potential uncompressible three-dimensional movement: wings of great span
VIII. Subsonic potential compressible movement: theory and linearization for thin wings and profiles
IX. Supersonic potential compressible movement: theory and linearization for thin wings and profiles
X. Introduction to numerical methods for calculating the characteristics of profiles and wings
XI. Lift and stall in real profiles and wings
XII. Aerodynamic drag of real profiles and wings

DESCRIPTION OF SKILLS

a. Understanding how aerodynamic forces determine the dynamics of flight and the role of the different variables involved in the phenomenon of flight
b. Applied knowledge of aerodynamics.
c. Adequate knowledge, applied to engineering, of the use of aerodynamic experimentation and of the most significant parameters in theoretical applications
d. An understanding of information from the field of aerodynamics gained from advanced textbooks, including aspects involving knowledge drawn from the cutting edge of aeronautics.
e. Formulating and arguing in favour of viewpoints and resolution of problems in aerodynamics through the application of the knowledge acquired, in a reasoned and professional way
f. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a scientific nature.
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
h. Ability to undertake further study of aerodynamics and the mechanics of flight with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Theory of Structures
Subject Area	Mechanics of Continuous Media
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	Physics, Mathematics

METHOD OF ASSESSMENT

Assessment will be by means of tests held at intervals throughout the semester, coinciding with the completion of explanation of homogeneous blocks of information. Marks will also be given for the activities undertaken and competences demonstrated individually and in group-work, carried out with or without the instructor.

At the end of the semester, there will be an examination on all of the material covered.

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	30		2	24	2.25	37.50	all
II. Practicals		30	2	24	2.25	37.50	all
III. Assessments	9	0	1	28	1.50	25.00	all
TOTAL	39	30	5	76	6	100	

Approximately 95% 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.

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

In classroom practical sessions, the instructor will aid students in the application of theoretical concepts and results to the resolution of problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, thus giving them skills in the use of the tools necessary for solving problems.

In practical classes in the laboratory specific commercially-available software for computer-assisted calculation of structures will be used.

CONTENTS

I. Basic concepts of elasticity: tension and deformation.
II. Elastic parts: bar model, laws of stress and strain.
III. Normal tension in bars.
IV. Tangential tension in bars.
V. Energy of deformation. Principle of virtual work.
VI. Calculation of movements in structures of bars.
VII. Introduction to the calculation of structures by means of the finite element method.
VIII. Structural instability.

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the principles of the mechanics of continuous media and the techniques for calculating their response.
b. Knowledge of the behaviour of structures faced with the demands of in-service conditions and extreme situations.
c. Applied knowledge of mechanics and the theory of structures.
d. Knowledge of the phenomena of structural instability.
e. Ability to analyse and solve problems.
f. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Manufacturing Processes
Subject Area	Mechanical Engineering and Fabrication
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment: All activities undertaken and competences exercised individually and in groups, whether working with or without the instructor, will be assessed. This will be achieved by assigning appropriate weightings to the following activities:

- Examinations covering theoretical and practical content.
- Work undertaken by students during the course, either individually or in a group.
- Reports on work carried out by students during laboratory practicals.

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. c. e
2. Practicals	6	24	0.5	12.5	1.72	28.67	a. b. d. e
3. Assessments	4	1.5	1	30	1.46	24.33	all
TOTAL	40	25.5	2	82.5	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 present the concepts, results and methods of the subject, by means of theoretical explanations and illustration with examples.
- In classroom practical sessions, the instructor will assist the students in applying theoretical concepts and results to the solving of problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, hence providing them with skills in the use of the tools necessary for resolving problems.
- In practicals in the workshop and laboratory, the instructor will guide students in using the equipment of a mechanical workshop and a metrology laboratory. Students will perform experiments that will aid them in grasping fundamental theoretical concepts and in these the students will make use of and link together concepts already covered in classes.

CONTENTS
I. **Introduction to fabrication engineering.** Classification of fabrication. Product development cycle II. **Dimensional metrology. Tolerances and fit.** Organization of measurement. Uncertainty in measurement. Dimensional tolerances and fit. III. **Shaping by moulding.** Fundamentals of the processes of casting. Description of the processes of casting. Faults and inspection. IV. **Shaping by plastic deformation.** Fundamentals of shaping by plastic deformation. Processes of shaping by plastic deformation. Common defects in shaping by plastic deformation. V. **Shaping by removal of material.** Mechanics of cutting. Financial aspects of machining. Analysis of the processes of machining. Components of machine tools. VI. **Shaping of polymers and compound materials.** Processes of shaping of thermoplastic materials. Processes of shaping of compound materials with a polymer matrix.
DESCRIPTION OF SKILLS
a. Ability to understand basic information about systems of production and fabrication. b. Adequate knowledge, applied to engineering, of the principal physical and mechanical characteristics and properties of materials. c. Understanding the technological performance and techniques for the optimizing of materials and modification of their properties by treatments. d. Applied knowledge of: the science and technology of materials. e. Effective development of spoken and written communication. f. Capacity for independent learning. g. Capacity for team work. h. Ability to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Airports
Subject Area	Airports and Air Transport
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test covering theoretical (50%) and practical contents (50%). When this test has been successfully completed, a weighted average will be calculated incorporating the mark for the report on practicals carried out at an airport as an outcome of practical work undertaken in seminars and presented publicly to the other students in the group. The weightings will be 85/15 respectively.

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	60	3.6	60.0	a, b, c, e, f, g, h, i, j
2. Practicals	16	12		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	49	12	1	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.
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.
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 S-type practicals in the classroom, the instructor will guide the students in applying theoretical concepts and results to the resolution of problems and to modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, hence providing them with skills in the use of the tools necessary for resolving problems
The remaining S-type sessions will be held at Leon Airport and the military base adjoining it, under the supervision of the instructor and in direct contact with professionals from the sector.

CONTENTS

I. Introduction to airports and air transport
II. Characteristics of aircraft and their impact on airport operation
III. Airports and the environment
IV. Capacity and delays
V. Master plan
VI. Airport lay-out
VII. Mountainous surroundings and consequent limitations
VIII. Signage
IX. Terminals for passengers
X. Terminals for freight
XI. Visual aids
XII. Electrical systems in airports
XIII. Surfaces, pavement and physical characteristics
XIV. Management and running of airports

DESCRIPTION OF SKILLS
a. Understanding of the particularities of the infrastructures, buildings and functioning of airports.
b. Adequate knowledge, applied to engineering, of the fundamentals of the design and construction of airports and their various component parts.
c. Understanding of the system of air transport and its co-ordination with other means of transport.
d. Applied knowledge of air transport.
e. Applied knowledge of environmental impact
f. Applied knowledge of finances and productivity.
g. Formulating and arguing in favour of viewpoints and solving problems of calculations and maintenance for airports through the application of the knowledge acquired, in a reasoned and professional way
h. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a scientific and technical nature
i. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
j. Ability to undertake further study of the designing of airport systems with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Control Systems
Subject Area	Aircraft
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth 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		1.0	35.0	2.72	45.33	a, b, d
II. Practicals		27.0	1.0	23.0	2.04	34.00	c, d, e, f, g, h, i
II. Assessments	4.0	2.0	1.0	24.0	1.24	20.67	All
TOTAL	36.0	29.0	3.0	82.0	6.00	100.0	

Student working time will be devoted to:

WORKING WITHOUT THE TEACHER

- Approximately 5% of student working hours will be spent on preparation for classes, reading material from a list supplied in advance by the instructor.

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

WORKING WITH THE TEACHER

- Approximately 92% of student work with instructors will involve attendance at timetabled sessions. The rest will be undertaken by means of the use of tools for long-distance communication. Nonetheless, to the extent that this is possible such use of tools for long-distance communication will be enhanced, so that student-teacher links will be more effective in regard of the management of teaching and learning: agreeing dates and times for tutorials, notifying deadlines for the handing in of work and announcing events of all sorts (lectures, talks, visits to industrial establishments and so forth).
- In type C sessions, the instructor will, when this appears appropriate, make use of technologies for remote access so as to illustrate theoretical concepts with practical industrial applications, thus achieving a complete blending of theory and practice.
- In S-type sessions, the instructor will guide the students in the application of theoretical concepts and results to the resolution of problems and their modelling in the field of automation. In this way, encouragement will at all times be given to critical thinking and the exchange of information between working groups and the concepts studied will be applied to the greatest possible number of specific cases. This will allow consolidation of the knowledge acquired (remote laboratory technology is used to access the greatest possible number of different industrial problems) and bring about a greater level of abstraction in students' ideas, with the creation of case-based structures of reasoning.

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

CONTENTS

I. Modelling of systems. Transfer functions of the principal components of aircraft.
II. Analysis in the domain of time. Responses of aircraft controls.
III. Analysis in the domain of frequency. Dynamics of aircraft.
IV. Closed-chain analysis. Design of regulators for aircraft controls.
V. Modern techniques for controlling aircraft.
VI. Flight automation systems.

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the basic principles of the control and automation of flight.
b. Applied knowledge of mechanics of flight.
c. Ability to design automatic control systems for aircraft.
d. Ability to understand and apply the principles of a basic awareness of control engineering and its application to aircraft.
e. Ability to learn independently and express critical opinions based on the interpretation of relevant data from the field of control engineering.
f. Ability to set up equipment and perform practical experiments in the laboratory.
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience, in spoken or written form.
h. Ability to adopt a critical attitude to previously used solutions, so as to encourage deeper study and analysis of the topics covered by this subject.
i. Ability to work in a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Project Management
Subject Area	Projects
Module	Common Core for Aeronautical Subjects
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Seventh semester
Prerequisites	None

METHOD OF ASSESSMENT

Students' marks will be based on assessment of:
- The theoretical knowledge they acquire.
- The quality of the reports submitted resulting from the work assigned.
- The degree to which good practice in project management is applied to the carrying out of the activities leading to the reports 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.	Assessments	3	5	1	20	1.16	19.33	all
TOTAL		33	25	2	90	6	100	

Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The rest will be done by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.
In classroom theoretical sessions, the instructor will introduce the concepts, results and methods of the subject, by means of theoretical explanations and examples as illustrations.
In sessions of type S the instructor will aid the students in the working out of practical cases, at all times encouraging the application of the methods described in guides to good practice in project management produced by prominent international bodies.

CONTENTS

I. Introduction to projects
II. Project management in the life-cycle of a project
III. Areas of knowledge in project management
IV. Methodological aspects of project management

DESCRIPTION OF SKILLS

a. Applied knowledge of projects.
b. 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.
c. 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.
d. Students should be able to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
e. Students should have developed the learning abilities necessary to undertake further studies with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Numerical Simulations in Aerospace Engineering
Subject Area	Physics
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Seventh Semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired may be done individually or in group work, by assigning appropriate weightings to the following activities:

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

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	18	8.5	0.25	30	2.27	37.8%	a, c, f, g
II. Practicals		27	0.25	50	3.09	51.5%	All
III. Assessments	6			10	0.64	10.7%	
TOTAL	24	35.5	0.50	90	6	100%	

All student work with instructors will require attendance at timetabled sessions.
Class sessions (C) comprise activities carried out in large groups of up to 70 students.
Seminar sessions (S) comprise activities carried out in "medium" groups of up to 20 students.
Tutorial sessions (T) comprise activities carried out individually or in some cases in small groups.

CONTENTS

I. Numerical analysis of partial differential equations:

1.- Partial differential equations: Classification. Methods for solving and direct simulation

2.- Techniques for discretization: Curvilinear co-ordinates and computational grids. Finite differences. Finite elements. Spectrum techniques.

3.- Effective specific implementation for parabolic, hyperbolic and elliptic equations. Consistency, stability and robustness of solutions.

II. Practical study of applications:

4.- Numerical aerodynamics. Implementation of simulations and analysis of results

5.- Computational dynamics of fluids. Implementation of simulations and analysis of results

DESCRIPTION OF SKILLS

Specific to the subject:

a) Adequate knowledge, applied to engineering, of the numerical simulation of the more significant

physico-mathematical processes.

b) Applied knowledge of mechanics and thermodynamics.

c) Ability to analyse and identify problems in aerospace engineering able to be simulated by partial differential equations and to solve them using computational numerical methods.

d) Ability to establish adequate computational strategies for refining and improving solutions of problems in aerospace engineering.

e) Understanding of the full procedure for numerical simulation of a process in the context of aerospace engineering and capacity to implement it on a computer by using the most appropriate computational tools available.

Transferrable:

f) Capacity for critical thinking and self-critique.

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

SUBJECT DESCRIPTION TABLE	
Subject Title	Fuels and Lubricants
Subject Area	Chemistry
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth Semester
Prerequisites	Successful completion of the subject Chemistry

METHOD OF ASSESSMENT

The method of assessment is intended to be continuous and based on:

1. A written examination on theoretical knowledge and problems. This will account for 80% of the final mark. This test essentially evaluates mastery of basic knowledge of the subject. Another aspect evaluated by this test is the structuring of the materials covered.
2. Laboratory practicals assessing the abilities acquired by students to apply their knowledge practically. The reports for all practicals must be submitted and attendance is compulsory. This will account for 20% of the final mark.

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	0.4	38	2.82	47.00	a,b,c,d,f,h
II. Practicals		20	1	23	1.76	29.33	a,b,c,d,e,f,g,i
III. Assessments	3	3	0.6	29	1.42	23.67	all
TOTAL	33	25	2	90	6	100	

All teaching and learning activities of students with the instructor 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 illustration with examples. This will be based on presentations of each of the topics (a list of which will be furnished to students in advance). These will not be confined to blackboard or whiteboard, but will also use overhead projectors and computer displays.

In classroom practical sessions, the instructor will assist students in applying theoretical concepts and results to the solution of problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for solving problems.

In practical sessions in the laboratory, the instructor will guide students to an awareness of safety and behaviour standards, in the use of the basic equipment of a fuels laboratory and in the employment of instruments to determine the physical and chemical properties of fuels and lubricants. Students will perform simple experiments to complement and exemplify the material covered in classes, for which they will make use of the tools for solving problems they have acquired.

CONTENTS

I. Petroleum. Sources of energy
II. Characterization of types of petroleum
III. Distillation of crude oil
IV. Processes of conversion in refineries
V. Combustion. Chemical and physical fundamentals
VI. Combustion of petrol and quality criteria
VII. Characteristics of diesel oil linked to its combustion
VIII. Combustion of fuels for jets and rockets. Quality criteria
IX. Lubrication and lubricants. Characteristics of lubricants
X. Types of lubricants

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the fuels and lubricants used in aircraft and automotive engines.
b. Ability to analyse and combine information
c. Ability to solve problems
d. Ability to think critically
e. Ability to learn independently
f. Sensitivity towards environmental matters
g. Capacity for team work

SUBJECT DESCRIPTION TABLE	
Subject Title	Aero-elasticity
Subject Area	Mechanics of Continuous Media
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Eighth semester
Prerequisites	Theory of Structures, Fluid mechanics, Thermodynamics and Aerodynamics

METHOD OF ASSESSMENT

The activities carried out and competences demonstrated whether individually or in group work,

undertaken either with or without the instructor, will be assessed.

At the end of the semester, there will be an examination on all the material covered in 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				
1. Theoretical Studies	30		2	31	2.50	41.67	all
2. Practicals		30	2	31	2.50	41.67	all
3. Assessments	9	3	0	13	1.00	16.67	all
TOTAL	39	33	4	74	6	100	

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

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 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 complete, thus acquiring skill in the use of the tools necessary for the resolution of problems.

CONTENTS

I. Static aero-elasticity.
II. Dynamic aero-elasticity. Flutter.
III. One-dimensional and two-dimensional structures.
IV. Fatigue. Analysis of fatigue in aircraft structures.
V. Mechanics of fracture. Energy approach and strain approach.

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the mechanics of fracture of a continuous medium and dynamic approaches to fatigue, structural instability and aero-elasticity
b. Ability to analyse and solve problems.
c. Ability to interpret results.

SUBJECT DESCRIPTION TABLE	
Subject Title	Jet Engines
Subject Area	Aircraft Engines
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester

Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group work, will be carried out in two phases. The first will consist of a written test covering theoretical (50%) and practical contents (50%). When this test has been successfully completed, a weighted average will be calculated incorporating the mark from the personal portfolio based on obligatory field-work carried out during the course. The weightings will be 85/15 respectively.

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	29		1	60	3.6	60.0	all
II. Practicals	12	16		28	2.24	37.3	all
III. Assessments	4			0	0.16	2.7	all
TOTAL	45	16	1	88	6	100	

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

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.

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

In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.

The remaining S-type sessions will be held in specific premises containing appropriate aeronautical material and in direct contact with professionals from the sector.

CONTENTS

I. Historical introduction and development of the jet engine
II. Types and basic lay-out of jet engines
III. Real cycles and approximations to move from the ideal cycle to real cycles
IV. Diffusers: structure and performance
V. Axial compressors: structure and performance
VI. Radial compressors: structure and performance
VII. Combustion chambers: structure and performance
VIII. Turbines: structure and performance
IX. Nozzles: structure and performance
X. Compressor-turbine coupling
XI. Afterburner: structure and performance
XII. Operational charts

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the methods for calculating and developing installations of propulsion systems (jets)
b. Applied knowledge of the operation of engines; engineering of propulsion systems based on jet engines
c. An understanding information in the field of aerospace engineering drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector
d. Formulating and arguing in favour of viewpoints and resolution of aerospace problems through the application of the knowledge acquired, in a reasoned and professional way
e. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social and scientific nature
f. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist

audience
g. Ability to undertake further study of aircraft engine assemblies with a high degree of autonomy

SUBJECT DESCRIPTION TABLE	
Subject Title	Turbojet Engines and Propellers
Subject Area	Aircraft Engines
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Sixth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of theoretical (50%) and practical (50%) materials covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark from the individual portfolio corresponding to field work of an obligatory sort carried out during the course. The weightings will be 85/15 respectively.

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	60	3.6	60.0	all
2. Practicals	16	12		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	49	12	1	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, in particular e-mail. As these tools improve and become more widespread, the extent to which they are used will increase.

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.

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

In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.

The remaining S-type sessions will take place in suitable premises containing appropriate aeronautical material and in direct contact with professionals from the sector.

CONTENTS

I. Basic theory of turbojets
II. Axial compressors: triangles of velocities
III. Axial compressors: multi-stage systems
IV. Radial compressors: impellers
V. Radial compressors: diffusers
VI. Compressors: calculation of forces and structural design
VII. Axial turbines: impulse and reaction
VIII. Radial turbines
IX. Turbines: calculation of forces and structural design

X.	Industrial applications of turbojets
XI.	Propellers: theory of the disc
XII.	Propellers: theory of components of blades
XIII.	Propellers: calculation of forces and structural design
XIV.	Real propellers: architecture and choice
XV.	Operation of propellers

DESCRIPTION OF SKILLS

a. Applied knowledge of aeroplane and engine operations
h. An understanding information in the field of aerospace engineering drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector
b. Formulating and arguing in favour of viewpoints and resolution of aerospace problems through the application of the knowledge acquired, in a reasoned and professional way
c. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social and scientific nature.
d. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
e. Ability to undertake further study of aircraft engine assemblies with a high degree of autonomy

SUBJECT DESCRIPTION TABLE

Subject Title	Aircraft Engine Assemblies
Subject Area	Aircraft Engines
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Eighth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of theoretical (40%) and practical (60%) materials covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark for the personal portfolio that will include all the field-work activities carried out during the course. The weightings will be 90/10 respectively.

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	60	3.6	60.0	all
2. Practicals	20	8		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	53	8	1	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.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be

set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.

The rest of the S-type sessions will take place in hangars and workshops, in direct contact with professionals from the sector.

CONTENTS

I. Design of hydraulic circuits for aircraft. Losses of fluid
II. Lubrication system
III. Fuel system. Design and regulation
IV. Ignition system
V. Internal air system. Cooling and pressurization. Ice prevention.
VI. Systems varying thrust. Thrust augmenters and direction-changing components.
VII. Systems for controlling the engine and propeller
VIII. Electronic systems (FADEC)
IX. Installation of engines in aeroplanes
X. Trials of propulsion systems. Ground and in-flight testing.
XI. Trials of propulsion systems. Safety zones. Noise suppression

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the regulation and control of propulsion system installations; use of experimental techniques, equipment and measuring instruments typical of the discipline; systems of maintenance and certification for aerospace engines.
b. An understanding of information in the area of the theory of aircraft engine assemblies drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector.
c. Formulating and arguing in favour of viewpoints and solving problems relating to aircraft engine installations through the application of the knowledge acquired, in a reasoned and professional way.
d. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social and scientific nature.
e. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
f. Ability to undertake further study in the area of aircraft engine assemblies with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Reciprocating Engines
Subject Area	Aircraft Engines
Module	Specific Technology
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (50%) and practical (50%) points covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark for the individual portfolio corresponding to the field-work activities of an obligatory nature carried out during the course. The weightings will be 85/15 respectively.

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	60	3.6	60.0	all
2. Practicals	12	16		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	45	16	1	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, particularly e-mail. As these tools improve and become more widespread, the extent to which they are used will increase.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
The rest of the sessions of type S will take place in suitable premises containing appropriate aeronautical material and in direct contact with professionals from the sector.

CONTENTS

I. Historical introduction and development of reciprocating engines
II. Types and basic lay-out of reciprocating engines
III. The connecting rod and crankshaft system
IV. Engine tuning
V. Renewal of fuel mix
VI. Fuel-supply systems in spark-ignition engines
VII. Ignition systems in spark-ignition engines
VIII. Fuel-supply systems in compression-ignition engines
IX. Lubrication and cooling.
X. Operations of air-breathing engines
XI. Supercharging
XII. Operations of supercharged engines
XIII. Similarities between engines
XIV. Trials of engines and the recording of parameters
XV. Polluting emissions

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the methods for calculating and developing propulsion system installations (reciprocating engines)
b. Applied knowledge of the operations of engines; engineering of propulsion systems based on reciprocating engines
c. An understanding of information in the field of aerospace engineering taken from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector
d. Formulating and arguing in favour of viewpoints and solving aerospace problems through the application of the knowledge acquired, in a reasoned and professional way
e. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social and scientific kind.
f. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
g. Ability to undertake further study of aircraft engine assemblies with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE

Subject Title	Propulsion
Subject Area	Propulsion
Module	Specific Technology

Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (40%) and practical (60%) material covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark from the individual portfolio that will include all field-work activities and individually-completed tasks done during the course. The weightings will be 90/10 respectively.

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	60	3.6	60.0	all
2. Practicals	20	8		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	53	8	1	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.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
The remaining S-type sessions will be carried out with models and real components of engines, under the supervision of the instructor.

CONTENTS

I. Introduction to propulsion
II. Concepts of mission, radius of action and range
III. Sizes of engines for different missions
IV. One-dimensional stationary flow of perfect gases
V. Propulsion systems: thrust equations
VI. Propulsion systems: ideal and real performance
VII. Thermodynamic cycles in propulsion systems and factors affecting thrust
VIII. Ramjet: definitions, thermodynamics and operations
IX. Pure turbojet: definitions, thermodynamics and operations
X. Double flow turbojet: definitions, thermodynamics and operations
XI. Turboprop: definitions, thermodynamics and operations
XII. Internal aerodynamics of a turbojet: diffusers
XIII. Internal aerodynamics of a turbojet: nozzles and shock waves
XIV. Internal aerodynamics of a turbojet: burners
XV. Introduction to the theory of propellers and operation charts
XVI. Rocket motors and other propulsion systems

DESCRIPTION OF SKILLS

a. Applied knowledge of internal aerodynamics and the theory of propulsion.
b. An understanding of information from the field of propulsion systems based on advanced textbooks,

including aspects involving knowledge obtained from the cutting edge of the aerospace sector.

c. Formulating and arguing in favour of viewpoints and resolution of aerospace problems through the application of the knowledge acquired, in a reasoned and professional way.

d. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social and scientific nature.

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

f. Ability to undertake further study in the area of internal aerodynamics and propulsion systems with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Graphic Design II
Subject Area	Graphic Design
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Second semester
Prerequisites	None

METHOD OF ASSESSMENT

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

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

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
I. Theoretical Studies	10	18	0.5	46	3	50.3	all
II. Practicals	6	21	0.5	22	2	32.6	all
II. Assessments	4	1	1	20	1	17.1	all
TOTAL	20	40	2	88	6	100	

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

CONTENTS

I. Descriptive geometry II
II. Fundamentals of design
III. Normalization II
IV. Computer-aided design

DESCRIPTION OF SKILLS
a. Ability to represent systems in space. b. Ability to handle normalized representation and drawing of sets. c. Ability to use tools for computer-aided graphic design for aerospace systems. 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 readings needed for industrial graphic representations, so as to permit reconstruction in space of the objects shown in projections f. Production and interpretation of normalized plans by handling and using the most suitable symbols, notes, standards and regulation. g. Mastery of the techniques of three-dimensional CAD modelling, leading to the carrying out of the process of conception, design and development of a project in a virtual environment.

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

METHOD OF ASSESSMENT

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

TEACHING AND LEARNING ACTIVITIES

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

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

CONTENTS

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

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

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

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

V. Professional communication in technical environments: Reports, abstracts, articles, case studies, manuals, oral presentations, memos, C.V.s and application letters, face-to-face interactions, phone calls, on-line communication.

DESCRIPTION OF SKILLS

a. Ability to operate satisfactorily in an English-speaking context, particularly in technological centres outside Spain, enhancing the skills of oral and written comprehension in the English language
b. Ability to draw up technical reports, descriptions of processes, C.V.s and other given documents relating to the general and technical management of research projects.
c. Knowledge of, and ability to use, the specific terminology relating to the field of study such as to permit a thorough understanding of the International Civil Aviation Organization and the functioning of the various modes of transport in the world transport system, with special emphasis on air transport.
d. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

SUBJECT DESCRIPTION TABLE

Subject Title	Materials Engineering
Subject Area	Mechanics of Continuous Media
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fourth semester
Prerequisites	Chemistry

METHOD OF ASSESSMENT

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

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

TEACHING AND LEARNING ACTIVITIES

Type of Activity	Student Work Hours (25 for each ECTS credit)				ECTS	%	Related Skills
	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	30		0.5	40	2.82	47	a,b,c,e
2. Practicals		24	1	15	1.6	26.67	all
3. Assessments	4	2	0.5	33	1.58	26.33	all
TOTAL	34	26	2	88	6	100	

Criteria:
Students will spend at least 5% of their working time without an instructor on preparation for classes, reading material from a list supplied in advance by the instructor.
Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

- In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
- In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
- In practicals in the laboratory, the instructor will guide the students to an awareness of the safety and behaviour standards for the use of the equipment and basic instruments of a materials laboratory. Students will carry out simple experiments to complement and exemplify the points covered in classroom sessions.

CONTENTS

I. **Fundamentals of Materials Science.** Atomic structures and bonds. Crystalline structure. Processes of diffusion. Mechanical and physical properties. Phase transformations.

II. **Ferrous Alloys.** Steels and cast iron. Heat treatments.

III. **Introduction to Non-ferrous Materials with Aeronautical Applications.** Aluminium and it alloys. Titanium and its alloys. Superalloys based on nickel. Polymers. Compound materials.

IV. **Effects of the Surroundings on Materials.** Oxidation and corrosion of metals. Break-down of polymers.

DESCRIPTION OF SKILLS

a. Knowledge of aeronautical materials.

b. Effective development of spoken and written communication.

c. Ability to learn independently.

d. Ability to work in a team.

e. Ability to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Mechanics of Flight
Subject Area	Aircraft
Module	Specific to ULE
Type	Compulsory
Number of ECTS Credits	6
Scheduling	Fifth semester
Prerequisites	None

METHOD OF ASSESSMENT

Assessment of student work and of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (40%) and practical (60%) points covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark from the portfolio of practicals involving laboratory experiments and simulations. The weightings will be 85/15 respectively.

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	60	3.6	60.0	a, b, d, e, f, g, h , i
2. Practicals	20	8		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	53	8	1	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.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
The remaining sessions of type S will be carried out using laboratory models and computer programs for simulations, under the supervision of the instructor.

CONTENTS

I. Introduction to the mechanics of flight
II. Aerodynamic forces
III. Propulsion forces
IV. Operations: glider operations.
V. Turbojet operations: level flight
VI. Turbojet operations: climbing and diving flight
VII. Turbojet operations: symmetrical turns in level flight
VIII. Turbojet operations: mixed operation
IX. Reciprocating engine operations: mixed operation
X. Take-off operations
XI. Landing operations
XII. Static stability and control: symmetrical straight flight (controlling pitch)
XIII. Static stability and control: free controls and forces on the joystick
XIV. Static stability and control: asymmetrical straight flight (controlling yaw)
XV. Static stability and control: symmetrical manoeuvring flight
XVI. Derivatives of stability

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of aircraft systems and automatic flight-control systems of air- and space-craft.
b. Adequate knowledge, applied to engineering, of the physical phenomena of flight, their features and control, aerodynamic and propulsion forces, operations, stability.
c. Formulating and arguing in favour of viewpoints and resolution of problems in the mechanics of flight through the application of the knowledge acquired, in a reasoned and professional way.
d. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a scientific and technical type.
e. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-

specialist audience.

f. Ability to undertake further study of the mechanics and control of flight with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Aircraft Calculations
Subject Area	Aircraft
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 of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (40%) and practical (60%) points covered. When this test has been successfully completed, a weighted average will be calculated incorporating a mark for a dossier of calculations for an aircraft, produced as an outcome of the practical tasks set in seminars and presented in public to the other students. The weightings will be 80/20 respectively.

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	60	3.6	60.0	a, c, d, e, f, g, h
2. Practicals	12	16		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	45	16	1	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.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
The remaining S-type sessions will be carried out using laboratory models and computer programs for simulations, under the supervision of the instructor.

CONTENTS

I. Introduction to aircraft calculations
II. Design requirements: operations in flight and on the runway
III. Design requirements: weights and ranges
IV. Design requirements: sustainable operation
V. General lay-out of a subsonic transport plane: architectures
VI. General lay-out of a subsonic transport plane: power plant
VII. General lay-out of a subsonic transport plane: wing

VIII.	General lay-out of a subsonic transport plane: fuselage
IX.	General lay-out of a subsonic transport plane: aerodynamic control surfaces
X.	Aircraft performance: estimation of weights and trim
XI.	Aircraft performance: aerodynamic drag and lift, drag coefficient
XII.	Certification and airworthiness
XIII.	Aircraft maintenance
XIV.	Rotary-wing aircraft: helicopter and autogyro
XV.	Design of aero generators
XVI.	Unmanned aircraft

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the methods for calculating aeronautical designs and projects; simulation, design, analysis and interpretation of experiments and in-flight operations; systems for the maintenance and certification of aircraft.
b. Applied knowledge of engineering of aircraft (fixed- and rotary-wing).
c. Adequate knowledge, applied to engineering, of: the use of aerodynamic experimentation and of the most significant parameters in theoretical applications.
d. An understanding of information in the field of aeronautical design based on advanced textbooks, including aspects involving knowledge derived from the cutting edge of aeronautics
e. Formulating and arguing in favour of viewpoints and solving problems of calculations for aircraft through the application of the knowledge acquired, in a reasoned and professional way
f. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a scientific and technical nature
g. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
h. Ability to undertake further study of the design of on-board aeronautical systems with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Satellites
Subject Area	Aircraft
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 of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (50%) and practical (50%) points covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark from a portfolio of calculations for a space mission, produced as an outcome of the practical tasks set in seminars and presented in public to the other students. The weightings will be 80/20 respectively.

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	60	3.6	60.0	a, b, d, e, f, g
2. Practicals	12	16		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	45	16	1	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.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
The remainder of the S-type sessions will be carried out using laboratory models and computer programs for simulations, under the supervision of the instructor.

CONTENTS

I. Introduction to space missions, the environment of space and its dynamics
II. Space programmes: the use of space
III. Useful space cargoes: communications
IV. Useful space cargoes: remote sensing
V. Useful space cargoes: navigation
VI. Space stations: characteristics and design
VII. Space stations: on-board data processing subsystem
VIII. Space stations: communications
IX. Space stations: attitude control subsystem
X. Space stations: electric power subsystem
XI. Space stations: heat control subsystem
XII. Space stations: subsystem of structure and mechanisms
XIII. Space stations: propulsion subsystem
XIV. Launch systems
XV. Launch vehicles and rockets
XVI. Ground control and operations

DESCRIPTION OF SKILLS

a. Adequate knowledge of the methods for analysing a space mission, including simulation, design, analysis and operations of space systems
b. Adequate knowledge, applied to engineering, of the fundamentals of sustainability, maintainability and operationality of space systems
c. Applied knowledge of cosmography
d. Adequate knowledge, applied to engineering, of the concepts and laws governing internal combustion and their application to rocket propulsion.
e. An understanding of information in the field of aeronautical design based on advanced textbooks, including aspects involving knowledge drawn from the cutting edge of aeronautics
f. Formulating and arguing in favour of viewpoints and solving problems in aircraft calculations through the application of the knowledge acquired, in a reasoned and professional way
g. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a scientific and technical nature
h. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
i. Ability to undertake further study of the design of aeronautical systems with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Hydraulics
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

In view of the extremely practical orientation it is intended to give to the course, assessment will attempt to reflect the degree of attainment of the objectives set by giving appropriate weightings to the following activities:

- Work periodically submitted, done individually or in a group.
- Reports on activities
- Written examinations with theoretical questions and practical exercises.
- Oral presentations.

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	25		1	40	2.64	44.4	a, b, c, d
II. Practicals		26	1	50	3.08	51.3	a,b, c, d
III. Assessments	6		1		0.28	4.6	a,b, c, d
TOTAL	31	26	3	90	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.
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.
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 the instructor will aid the students in the application of the knowledge acquired to the drawing up of a project.
Tutorials will be devoted to clearing up those points on which students have doubts and to commenting on and directing the progress of the project.

CONTENTS

I. Further fluid mechanics.
II. Water supply systems
III. Fire protection installations
IV. Drainage systems (drains and sewers)
V. Special installations at airports

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of: the fundamentals of fluid mechanics describing flows under all conditions, so as to determine the distribution of pressures and forces on aircraft.
b. Applied knowledge of hydraulics.
c. Students should be able to apply their knowledge to their job 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 be capable of transmitting information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

SUBJECT DESCRIPTION TABLE	
Subject Title	Aeronautical Meteorology
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 of the skills acquired, individually and/or in group-work, will be achieved by assigning appropriate weighting to the following activities:
- Examinations.
- Work to be submitted (practical case studies).
- Complementary activities (seminars).
- Oral presentations.

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	28	2	0.5	32	2.5	41.66	a, b, c
II. Practicals	2	20	0.5	40	2.5	41.66	All
II. Assessments	4	1	0.5	19.5	1	16.66	All
TOTAL	34	23	1.5	91.5	6	100	

In classroom theoretical sessions the instructor will present the concepts, results and methods of the subject, through explanations and examples as illustrations.

In classroom practical sessions the instructor will guide students in the application of theoretical concepts and results to the solving problems, at all times encouraging critical thinking. Furthermore, exercises will be set for the students to complete thus providing them with skills in the use of the tools necessary for resolving problems.

In addition, some of the exercises (in seminars) will be organized so as to encourage independent learning, searching for and analysing information, group work, a capacity for spoken communication and arguing in favour of views proposed.

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. To the extent that these tools improve and become more widespread, their percentage of employment will grow.

CONTENTS

I. Physical principles of Meteorology
II. The physics of clouds
III. Dynamics of the atmosphere
IV. Weather forecasting
V. Aeronautical meteorological instruments

VI. Codification and interpretation of meteorological data
VII. Aeronautical climatology

DESCRIPTION OF SKILLS

a. Applied knowledge of meteorology.
b. Ability to gather and interpret relevant meteorological data so as to express opinions during the course of professional activities.
c. Ability to formulate and argue in favour of viewpoints and solve problems.
d. Ability to apply the knowledge acquired to their work in a professional manner.
e. Capacity for analysis.
f. Effective development of spoken and written communication aimed either at a specialist or at a non-specialist audience.
g. Ability to work in a team.
h. Capacity for independent learning

SUBJECT DESCRIPTION TABLE	
Subject Title	Noise and Vibrations
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 of the skills acquired, individually and/or in group-work, will be achieved by assigning appropriate weighting to the following activities:
- Tasks submitted at intervals, whether undertaken individually or in group work.
- Reports on activities
- Written examinations with theoretical questions and practical exercises.
- Oral presentations.

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	45	3.20	53.33	a, b, d
II. Practicals	5	16	1	15	1.48	24.67	all
II. Assessments	4	1	1	27	1.32	22.00	all
TOTAL	39	21	3	87	6	100	

All teaching and learning activities of types C and S with the instructor will require attendance at timetabled sessions. Tutorials may be carried out by means of tools for long-distance communications to the extent that such tools improve and become more generalized.
In classroom theoretical sessions the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
In classroom sessions of type S the instructor will aid the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.
In practical sessions in the laboratory the instructor guide the students to a knowledge of the basic

equipment for acoustics and vibrations and in the handling of instruments, procedures and techniques for performing standardized measurements, and for analysing the results.

CONTENTS

I. Fundamentals of acoustics, magnitudes, levels, descriptors and indices.
II. Acoustic instruments and measurements
III. Noise limitation, the impact of noise, acoustic charts, noise regulation.
IV. Fundamentals of vibrations, magnitudes, quantification, assessment and measurement
V. Propagation and control of vibrations

DESCRIPTION OF SKILLS

a. Applied knowledge of the generation and propagation of noise, acoustic charts for airport infrastructures, the impact of noise pollution in airport environments, pollution indices, limits of tolerance, methods for noise control and regulation of noise in commercial aviation.
b. Knowledge of vibrations.
c. Ability to perform and interpret calculations on the basis of experiments performed.
d. Ability to learn independently.
e. Ability to work in a group.
f. Ability to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.

SUBJECT DESCRIPTION TABLE

Subject Title	Air Traffic Control
Subject Area	Aerial Navigation
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 of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (40%) and practical (60%) materials covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark for the individual portfolio that will include all the practical activities carried out during the course. The weightings will be 85/15 respectively.

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	60	3.6	60.0	all
2. Practicals	16	12		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	49	12	1	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.
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.
In classroom theoretical sessions, the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.

The remainder of the S-type sessions will be held at airports, in hangars and workshops, in direct contact with professionals working in this sector.

CONTENTS

I. Air transport: fundamentals of air law and the legislative context for civil aviation
II. Air transport: the Chicago Convention and other international agreements
III. Air transport: organizations for government co-operation: ICAO
IV. Air transport: organizations for business co-operation: IATA
V. Air transport in Spain: data and legal framework
VI. Aircraft operation: general standards for operating aircraft
VII. Aircraft operation: certificates of airworthiness and type
VIII. Aircraft operation: on-board and ground equipment for appropriate operation
IX. Aircraft operation: analysis of cruising, manoeuvring and control
X. Aircraft operation: systems assisting aerial navigation
XI. Aircraft operation: radius of action and specific range
XII. Aircraft operation: consumption
XIII. Aircraft operation: unit costs and productivity
XIV. Aircraft operation: payload and range considerations
XV. Aircraft operation: safety of flight operations
XVI. Airlines: the aviation market and supply and demand profiles
XVII. Airlines: costs of running fleets
XVIII. Airlines: air prices and tariffs

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of requirements of on-board and ground equipment to ensure acceptable operations; flight operation of aerospace systems
b. Adequate knowledge, applied to engineering, of the planning, design and installation of systems to support air traffic management
c. Adequate knowledge, applied to engineering, of the methods for calculating and developing aerial navigation; calculations for the systems specific to aerial navigation and their infrastructures
d. Adequate knowledge, applied to engineering, of the actions, manoeuvres and control of aircraft
e. Adequate knowledge, applied to engineering, of the air traffic standards applicable; the functioning and management of air transport; navigation systems and air traffic; aerial communication and surveillance systems
f. Applied knowledge of the distribution, management and economics of air transport
g. An understanding of information from the field of air traffic drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector.
h. Formulating and arguing in favour of viewpoints and resolution of problems of air traffic through the application of the knowledge acquired, in a reasoned and professional way.
i. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social, scientific or technical nature.
j. Capacity to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
k. Ability to undertake further study in the field of air traffic with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Aerospace Sustainability
Subject Area	Environmental Studies
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 of the skills acquired, individually and/or in group-work, will be achieved by assigning appropriate weighting to the following activities:

- Tasks to be completed and handed in at intervals, whether done individually or in group work
- Reports and active participation in lectures and seminars
- Work to be submitted: presentation and coping with queries
- An examination at the end of 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				
1. Theoretical Studies	29		1	60	3.6	60.0	all
2. Practicals	16	12		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	49	12	1	88	6	100	

In classroom theoretical sessions, the instructor will present the concepts, results and methods applied in environmental studies, by means of theoretical explanations and illustrative examples.
In classroom practical sessions the instructor will aid the students in the application of concepts, definitions and methods for the identification and evaluation of impacts and corrective measures, at all times encouraging participation and critical thinking.
Exercises will be set for the students to complete, thus providing them with skill in the use of the tools necessary to identify environmental impacts and propose corrective measures.
In practicals in seminar groups, the instructor will guide the students to a knowledge of matrices and tables and of the legal environmental standards applied.

CONTENTS

Theory:

I. Sustainability: definitions and concepts. Methodology.
II. Climate change – Environmental policies (World, European, Spanish, local).
III. Pollution. Environmental impacts and corrective measures:
  Atmospheric
  Water
  Soil
IV. Natural resources and their management
V. Residues and treatment: legal framework.
VI. Other sustainability factors: renewable energies.
VII. Environmental quality. Tools for environmental management:
  a) Assessment of environmental impact
  b) Systems for environmental management and audits
  c) Analysis of the life-cycle of aerospace materials.

Experimental/Practical:

I. Sustainable development applied to the aeronautical sector (seminar).
II. Climate change: greenhouse effect gases and their environmental impacts (literature review and analysis)
III. Pollution: pollutants, sources and impacts (tutor-supported tasks for students)
IV. Natural resources: management and protection of water and soils, raw materials.
V. Residues and their environmental management. Legal framework.
VI. Other sustainability factors and environmental impacts. Renewable energies.
VII. Management and environmental quality tools applied to aerospace systems.
  EIA: Environmental impact assessment (matrices for analysing impacts and their evaluation)
  Environmental management system (ISO 14.000)

DESCRIPTION OF SKILLS

a. Fundamentals of sustainability, maintainability and operationality of aeronautical systems.

b. Adequate knowledge, applied to engineering, of the fundamentals of sustainability, maintainability and operationality of aerial navigation systems.
c. Adequate knowledge, applied to engineering, of the fundamentals of sustainability, maintainability and operationality of air- and space-craft and space systems.
d. Adequate knowledge, applied to engineering, of the environmental impact of infrastructures.
e. An understanding of information in the field of environmental impacts of aerospace operations drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector
f. Formulating and arguing in favour of viewpoints and solving environmental problems in the aerospace context through the application of the knowledge acquired, in a reasoned and professional way
g. Interpretation of sets of relevant data so as to express opinions including evidence of reflection of a social and scientific nature.
h. Capacity to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience.
i. Ability to undertake further study of the environmental technologies for aerospace operations with a high degree of autonomy.

SUBJECT DESCRIPTION TABLE	
Subject Title	Airport Engineering: Airport Buildings and Installations
Subject Area	Airports and Air Transport
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Theory of Structures, Electrical Technology

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	24	2.25	37.50	all
II. Practicals		30	2	24	2.25	37.50	all
II. Assessments	9	0	2	27	1.50	25.00	all
TOTAL	39	30	6	75	6	100	

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.

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 complete, hence providing them with skills in the use of the tools necessary for resolving problems.

CONTENTS

I. Building actions: standards and materials.
II. Typology of structures.
III. Urbanization.
IV. Terminal buildings. Control tower.
V. Installations: electrical, lighting, air-conditioning, heating.
VI. Energy optimization and management. Environmental impact.
VII. Centres for control of installations.

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the materials used in building; the requirements and development of airport infrastructures and their environmental impact; the buildings necessary for the operation and functioning of airports.
b. Applied knowledge of building; airport installations; maintenance and running of airports; air transport.
c. Applied knowledge of cartography, topography and land studies.
d. Adequate knowledge, applied to engineering, of specific building standards; the procedures for control and execution of works; the functioning and management of airports and air transport.
e. Adequate knowledge, applied to engineering, of methods of for calculating and of developing the various solutions for building and paving airports; calculations for systems specific to airports and their infrastructures; evaluation of technical and financial operations of aircraft; the handling of the experimental techniques, equipment and measuring instruments typical of the discipline; safety and control plans in airports.
f. Ability to analyse and resolve problems.
g. Ability to interpret results.

SUBJECT DESCRIPTION TABLE

Subject Title	Materials and Maintenance of Aeronautical Systems
Subject Area	Aerospace Equipment and Materials
Module	Specific to ULE
Type	Optional
Number of ECTS Credits	6
Scheduling	Sixth, seventh or eighth semester
Prerequisites	Materials Engineering

METHOD OF ASSESSMENT

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

- Examinations.
- Tasks to be completed individually or in groups and submitted for marking.
- Reports on laboratory work.

TEACHING AND LEARNING ACTIVITIES

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

	With Instructor			Without Instructor			
	C	S	T				
1. Theoretical Studies	30		0.5	40	2.82	47	a,c,e
2. Practicals		24	1	15	1.6	26.67	all
3. Assessments	4	2	0.5	33	1.58	26.33	all
TOTAL	34	26	2	88	6	100	

Criteria:
Students will spend at least 5% of their working time without an instructor on preparation for classes, reading material from a list supplied in advance by the instructor.
Approximately 95% of student work with instructors will involve attendance at timetabled sessions. The remainder will be carried out by means of the use of tools for long-distance communication. As these tools improve and become more widespread, the extent to which they are used will increase.

- In classroom theoretical sessions the instructor will present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.
- In classroom practical sessions, the instructor will aid the students in the application of theoretical concepts and results to the resolution of problems, at all times encouraging critical thinking. Exercises will be set for the students to complete, thus acquiring skill in the use of the tools necessary for solving problems.
- In practicals in the laboratory, the instructor will guide the students to a knowledge of the safety and behaviour standards in the use of the basic equipment and instruments of a materials laboratory. Students will perform simple experiments to complement and exemplify the points covered in classes.
- In practicals using computers, the instructor will assist students to seek materials suited to specific applications.

CONTENTS

I. Behaviour of materials in use. Fracture. Fatigue. Yield. Corrosion resistance under stress. Methods for testing and detection of faults.

II. Metals and alloys. Classification. Heat treatments. Applications.

III. Compound materials. Types. Applications.

IV. Standards for aircraft maintenance

V. Management of serviceability

VI. Maintenance techniques for aircraft

VII. Testing aeronautical systems

VIII. Repairs: layout and management of workshops and tools

IX. Certification

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of: techniques for inspection, quality control and fault detection; the most appropriate methods and techniques for repairs.
b. An understanding of information in the field of aircraft maintenance drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector.
c. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social or scientific and technical nature.
d. Capacity to convey information, ideas, problems and solutions to both specialist and non-specialist audiences.
e. Ability to undertake further study in the field of aircraft maintenance with a high degree of autonomy.
f. Effective development of spoken and written communication.
g. Capacity to learn independently.
h. Ability to work in a team.
i. Ability to analyse and solve problems.

SUBJECT DESCRIPTION TABLE	
Subject Title	Rockets and Missiles
Subject Area	Aerospace Equipment and Materials
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 of the skills acquired, individually and/or in group-work, will be carried out in two phases. The first will consist of a written test of the theoretical (50%) and practical (50%) materials covered. When this test has been successfully completed, a weighted average will be calculated incorporating the mark for a portfolio of calculations for a space mission derived from the practical tasks set in seminars and presented in public before the other students. The weightings will be 80/20 respectively.

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	60	3.6	60.0	all
2. Practicals	16	12		28	2.24	37.3	all
3. Assessments	4			0	0.16	2.7	all
TOTAL	49	12	1	88	6	100	

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

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.

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

In classroom sessions of type S, the instructor will guide the students in applying theoretical concepts and results to the solution of problems and modelling them in the field of engineering, at all times encouraging critical thinking and the exchange of information between working groups. Exercises will be set for the students to complete, thus providing them with skills in the use of the tools necessary for resolving problems.

The remaining S-type sessions will be held in laboratories equipped with models and simulators, and in military installations, in direct contact with professionals from the sector.

CONTENTS

I. Introduction to rockets and missiles
II. Trajectories: ballistics, propulsion systems
III. Aerodynamic and structural design
IV. Mechanics of flight and control systems
V. Nozzles
VI. Solid-fuel motors
VII. Liquid-fuel motors
VIII. Hybrid motors

IX.	Electric and magnetic propulsion motors
X.	Laws for rocket and missile guidance and navigation: problems and generic equations
XI.	Laws for rocket and missile guidance and navigation: inertial system
XII.	Laws for rocket and missile guidance and navigation: GPS system
XIII.	Laws for rocket and missile guidance and navigation: other techniques
XIV.	Stability and manoeuvrability

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of the physical phenomena of the flight of air defence systems, their characteristics and how they are controlled, operations, stability and automatic control systems, methods for calculating and developing defence materials and systems
b. Applied knowledge of the engineering of air defences (ballistics, missiles and aerial systems) and spacecraft propulsion
c. An understanding of information from the field of air defence engineering drawn from advanced textbooks, including aspects involving knowledge obtained from the cutting edge of the aerospace sector
d. Formulating and arguing in favour of viewpoints and solving problems in spacecraft propulsion through the application of the knowledge acquired, in a reasoned and professional way
e. Interpretation of sets of relevant data so as to express opinions including evidence of reflection on appropriate topics of a social and scientific type.
f. Capacity to transmit information, ideas, problems and solutions either to a specialist or to a non-specialist audience
g. Ability to undertake further study of rockets and missiles with a high degree of autonomy

SUBJECT DESCRIPTION TABLE

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

METHOD OF ASSESSMENT

Assessment of student work and the skills acquired, either individually or in group work, whether or not during attendance at timetabled sessions, will be achieved by assigning appropriate weightings to the following activities:
- In-class tests.

Together where appropriate with:
- Work to be 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				
a. Theoretical Studies	24		1	30	2.16	36.67	a, b, c, d, f
b. Practicals	10	20		30	2.40	40	a, b, c, d, e, f, g
c. Assessments	4		1	30	1.40	23.33	a, b, c, d, f
TOTAL	38	20	2	90	6	100	150 hours

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 present the concepts, results and methods of the subject, by means of theoretical explanations and illustrative examples.

In S-type sessions in the classroom 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 and the exchange of information between working groups. Exercises will be set for the students to complete, thus acquiring skill in the use of the tools necessary for resolving problems.

The remaining S-type sessions will involve practical work in the laboratory. In such sessions the instructor will introduce the students to a knowledge of the safety and behaviour standards and the use of various instruments.

CONTENTS

I. Basic analysis of electric circuits.
II. Basic principles of electromagnetism.
III. Classification of electric machines.
IV. Transformers.
V. Induction motors.
VI. Alternating current generators.
VII. Electrical installations in the aerospace context.

DESCRIPTION OF SKILLS

a. Applied knowledge of electricity and technology.
b. Adequate knowledge, applied to engineering, of electric installations.
c. Applied knowledge of electric installations in the land and air sectors.
d. Ability to perform and interpret the calculations for the experiments and problems undertaken.
e. Ability to learn independently.
f. Ability to work as part of a team.

SUBJECT DESCRIPTION TABLE	
Subject Title	Electronics in Communication and Navigation Systems
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 at, and participation in, debates and individual and/or group work; completion of tasks or case studies; unprompted 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				

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

Student work with instructors will involve attendance at timetabled sessions in all cases

Students will follow the indications given by the instructor relating to analysing and reading texts and the preparation of materials prior to each theoretical and practical session, this to be done in the students' working time without a teacher.

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

In classroom practical sessions, the instructor will aid the students in the application of concepts and techniques for solving problems, at all times encouraging analytical and critical thinking. Exercises will be set for the students to complete, thus giving them skills in the use of the tools necessary for resolving problems typical of the field.

In practical sessions in the laboratory, the instructor will guide the students in independent work, a knowledge of the safety and behaviour standards for the use of specific laboratory tools and instruments and the techniques and tools for designing electronic systems. Real or simulated experiments will be performed to complement and exemplify the points covered in classes and the working methods of the field.

CONTENTS

I. Fundamentals of electronic systems
II. Analog and digital signals. Conditioning and transmission. Spectrum.
III. Electronic components, circuits and instrumentation
IV. Communications circuits and systems in the aeronautical context
V. Radio broadcast systems for aiding navigation
VI. Radio broadcast systems for position finding

DESCRIPTION OF SKILLS

a. Adequate knowledge, applied to engineering, of electronic installations
b. Applied knowledge of electronics
c. Applied knowledge of transmitters and receivers; transmission lines and systems broadcasting signals for aerial navigation
d. Ability to take decisions, analyse and solve problems with initiative, creativity and critical thinking.
e. Ability to perform measurements and calculations and handle specifications, regulations and standards.
f. Ability to communicate and transmit, in spoken and written form, knowledge, reasonings and descriptions of abilities and skills.
g. Capacity for independent learning.
h. Ability to work in a team, organize and plan with a focus on 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	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
II. Assessments			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 aerospace 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.