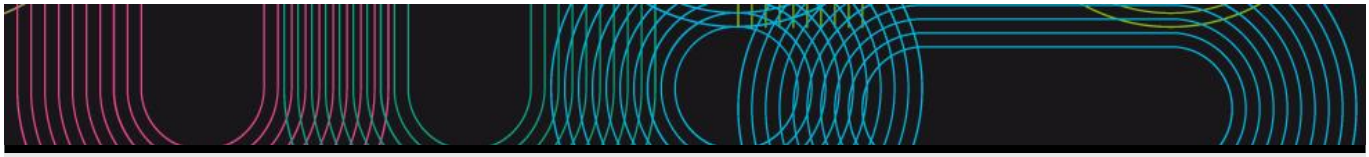

(*)Escola de Enxeñaría de Telecomunicación

(*)Páxina web

(*)

www.teleco.uvigo.es

(*)Presentación

The School of Telecommunication Engineering (EET) is a higher education school of the University of Vigo that offers Bachelor's degrees, Master's degrees and Doctoral programs in the fields of Telecommunications Engineering.

Bachelor's Degree in Telecommunication Technologies Engineering (EUR-ACE®).

The mail goal of the Bachelor's Degree in Telecommunication Technologies Engineering is to form professionals at the forefront of technological knowledge and professional competences in telecommunication engineering. This Bachelor has been recognized with the best quality seals, like the EUR-ACE's. **It has a bilingual option: up to 80% of the degree credits can be taken in English**.

http://teleco.uvigo.es/images/stories/documentos/gett/degree_telecom.pdf

www: http://teleco.uvigo.es/index.php/es/estudios/gett

Master in Telecommunication Engineering

The Master in Telecommunication Engineering is a Master's degree that qualifies to exercise the profession of Telecommunication Engineer, in virtue of the established in the Order CIN/355/2009 of 9 of February.

http://teleco.uvigo.es/images/stories/documentos/met/master_telecom_rev.pdf

www: http://teleco.uvigo.es/index.php/es/estudios/mit

Interuniversity Masters

The current academic offer includes interuniversity master's degrees that are closely related to the business sector:

Master in Cybersecurity: www: https://www.munics.es/

Master in Industrial Mathematics: www: http://m2i.es

International Master in Computer Vision: www: https://www.imcv.eu/

(*)Equipo directivo

MANAGEMENT TEAM

Directora: Rebeca Pilar Díaz Redondo (teleco.direccion@uvigo.gal)

Secretaría e Subdirección de Novas Titulacións: Pedro Rodríguez Hernández

(teleco.subdir.secretaria@uvigo.gal;teleco.subdir.novastitulacions@uvigo.gal)

Subdirección de Organización Académica: Pedro Comesaña Alfaro (teleco.subdir.academica@uvigo.gal)

Subdirección de Relaciones Internacionais e Subdirección de Infraestructuras: María Verónica Santalla del

Río (teleco.subdir.internacional@uvigo.gal; teleco.subdir.infraestructuras@uvigo.gal)

Subdirección Difusión e Captación: Laura Docio Fernández (teleco.subdir.captacion@uvigo.gal)

Subdirección de Calidade: Ana María Cao Paz(teleco.subdir.calidade@uvigo.gal)

BACHELOR□SDEGREE IN TELECOMMUNICATION TECHNOLOGIES ENGINEERING

Generalcoordinator: Lucía Costas Pérez (teleco.grao@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-gett/

MASTER IN TELECOMMUNICATION ENGINEERING

Generalcoordinator: Manuel García Sánchez (teleco.master@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-met/

MASTER INCYBERSECURITY

General coordinator:Ana Fernández Vilas (teleco.munics@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-munics/

MASTER ININDUSTRIAL MATHEMATICS

Generalcoordinator: Elena Vázquez Cendón (USC)

UVigo coordinator:José Durany Castrillo (durany@dma.uvigo.es)

http://www.m2i.es/?seccion=coordinacion

INTERNATIONALMASTER IN COMPUTER VISION

General coordinator: Xose Manuel Pardo López (USC)

UVigo coordinator:José Luis Alba Castro (jalba@gts.uvigo.es)

https://www.imcv.eu/legal-notice/

MASTER'S DEGREE IN QUANTUM INFORMATION SCIENCE AND TECHNOLOGIES (MQIST)

General coordinator: Javier Mas (USC)

Coordinador UVIGO: Manuel Fernández Veiga(teleco.mqist@uvigo.es)

https://quantummastergalicia.es/info

Grado en Ingeniería de Tecnologías de Telecomunicación

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V05G301V01101	Mathematics: Calculus 1	1st	6
V05G301V01102	Mathematics: Linear algebra	1st	6
V05G301V01103	Physics: Fundamentals of Mechanics and Thermodynamics	1st	6
V05G301V01104	Business: Company Fundamentals	1st	6

V05G301V01105	Programming I	1st	6
V05G301V01106	Mathematics: Calculus 2	2nd	6
V05G301V01107	Mathematics: Probability and Statistics	2nd	6
V05G301V01108	Physics: Analysis of Linear Circuits	2nd	6
V05G301V01109	Informatics: Computer Architecture	2nd	6
V05G301V01110	Programming II	2nd	6

IDENTIFYING DATA				
Mathematics: Calculus 1				
Subject	Mathematics: Calculus 1			
Code	V05G301V01101			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Fernández Manin, Generosa			
Lecturers	Bajo Palacio, Ignacio Calvo Ruibal, Natividad Fernández Manin, Generosa Prieto Gómez, Cristina Magdalena			
E-mail	gmanin@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The aim of this subject is to introduce the student in the basic techniques of Differential Calculus in one and several real variables and its applications. At the end of the semester it is expected that students have achieved the understanding of the basic concepts, handle the usual differential operators of the mathematical physics and learn the techniques of differential calculus for the determination of extremes local approximation of functions and numerical solution of systems of equations. Besides, the student will learn to handle some computer programs of symbolic calculation and graphic representation.			

Training and Learning Results	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C1	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations; numerical methods, numerical algorithms, statistics and optimization
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject	Training and Learning Results		
Understanding of the basic concepts of the differential calculation in one and several variables.	B3 B4	C1	D2 D3
Knowledge and handle of the usual differential operators of the mathematical physics.		C1	
Knowledge and handle of the technicians of differential calculation for the research of extremes, the local approximation of functions and the numerical resolution of systems of equations.	B4	C1	D2
Knowledge of some computer program of symbolic calculation and graphic representation.	B3		D3

Contents	
Topic	
Topic 1. Introduction.	Sets of numbers and functions of one variable.
Topic 2. Continuity of functions of one variable.	Limit of a function in a point. One-sided limits. Continuity. The intermediate value theorem. Bolzano's theorem. The bisection method.
Topic 3. Continuity of functions of several variables.	n-dimensional space. Inner product, Norm. Vector product. Functions of several variables. Limits. Continuity. Bolzano's theorem.

Topic 4. Derivatives of functions of one variable and applications of the derivative.	Derivatives of a function at a point. Derivative function, successive derivatives, properties. Chain rule. Implicit differentiation. Derivative of inverse functions. Maxima and minima. Mean value theorem. L'Hopital's rule. Local study of the graph of a function. Taylor polynomials. Newton's method.
Topic 5. Differential of functions of several variables.	Directional derivatives. Partial derivatives. Jacobian matrix. The chain rule. Higher order derivatives. Differential operators.
Topic 6. Applications of the differential calculus.	Extreme values. Extreme values with equality constraints. Newton's method.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	47	61.5	108.5
Problem solving	9	14	23
Laboratory practical	2	1.5	3.5
Problem and/or exercise solving	1	1	2
Problem and/or exercise solving	1	2	3
Problem and/or exercise solving	1	3	4
Problem and/or exercise solving	2	4	6

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The teachers will expose the theoretical contents of the matter. Through this methodology competencies CG3, CE1 and CT3 are developed.
Problem solving	The teachers will solve problems and exercises of each of the topics and the student will have to solve similar exercises. Through this methodology competencies CG3, CG4, CE1, CT2 and CT3 are developed.
Laboratory practical	The students will use computer tools (Maxima and/or Matlab) to solve exercises and apply the knowledge achieved in the theoretical classes. Through this methodology competencies CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized assistance

Methodologies	Description
Lecturing	The teachers will discuss personally the doubts and queries of the students in the schelude of personal tutorials (http://moovi.uvigo.gal) in person, whenever this is possible, and also by the distance learning method, through appointment modality, using the telematic means provided by the Universidade of Vigo.
Problem solving	The teachers will discuss personally the doubts and queries of the students in the schelude of personal tutorials (http://moovi.uvigo.gal) in person, whenever this is possible, and also by the distance learning method, through appointment modality, using the telematic means provided by the Universidade of Vigo.

Assessment

Description	Qualification	Training and Learning Results	
Problem and/or exercise solvingFirst session (1 hour): Topic 1.	10	B3 B4	C1
Problem and/or exercise solvingSecond session (1 hour): Topics 2 and 3.	20	B3 B4	C1
Problem and/or exercise solvingThird session (1 hour): Topics 4 and 5.	30	B3 B4	C1
Problem and/or exercise solvingFinal exam on topics 5 and 6 of the subject.	40	B4	C1

Other comments on the Evaluation

Following the guidelines of the degree, two evaluation systems will be offered to the students: continuous assessment or exam-only assessment.

1. Continuous assessment

Continuous assessment consists of the previous three one-hour sessions detailed and a final exam. If a student cannot attend a particular test on the date for which it is scheduled, he or she will miss that test.

In this case, the final grading for a student is given by the formula:

N = C + E

C : grading, between 0 and 6, obtained as the sum of the marks of the three one-hour sessions.

E : grading, between 0 and 4, obtained in the final exam on the topics 5 and 6 of the subject.

In this mode, a student has successfully completed the course when N is greater than or equal to 5. Gradings obtained in the tests will be valid only for the academic year in which they are done.

On the day of final exam, the students can choose continuous evaluation or to be graded exclusively with global assessment.

2. Global assessment and end-of-program call

Those students who do not choose to be graded by continuous assessment, will be graded by means of a final exam (topics: 1, 2, 3, 4, 5, and 6) which will not necessarily be the same as the one for the students who chose continuous assessment. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

3. Extraordinary exam

On the day of this second final exam, the students who were graded by continuous evaluation may choose to be graded exclusively by this second exam or to be graded taking into account the points obtained in their continuous evaluation by the same formula used earlier, that is:

NR= C + D

C : Mark, between 0 and 6, obtained as the sum of the gradings of the one-hour sessions.

D : Mark, between 0 and 4, obtained in an exam on the topics 5 and 6 of the subject.

In this mode, a student has successfully completed the course when NR is greater than or equal to 5.

Those students who choose to be graded exclusively by the second final exam on topics: 1, 2, 3, 4, 5, and 6 which will not necessarily be the same as the one for the students who made the other choice. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

4. Qualification of ''No Presentado''

A student will obtain a qualification of ''No Presentado'' if the student did not attend sessions of continous evaluation and did not attend the final exams.

5. Ethical behaviour

It is expected a correct and ethical behavior of all students in all written tests and exams, which are meant to truly reflect the knowledge and abilities attained by each student. Any unethical behavior detected in a particular test (such as copying or using prohibited material) will result in a grading of 0 in that test and the incident will be reported to the corresponding academic authorities for prosecution.

Sources of information

Basic Bibliography

J. Stewart, **Cálculo de una variable: conceptos y contextos.**, 4ª edición, Cengage Learning, 2011

E. Marsden y A.J. Tromba, **Cálculo vectorial**, 6ª edición, Pearson, 2018

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Physics: Analysis of Linear Circuits/V05G301V01108
Mathematics: Calculus 2/V05G301V01106
Mathematics: Probability and Statistics/V05G301V01107
Physics: Fields and Waves/V05G301V01202
Digital Signal Processing/V05G301V01205
Electromagnetic Transmission/V05G301V01207

Subjects that are recommended to be taken simultaneously

IDENTIFYING DATA				
Mathematics: Linear algebra				
Subject	Mathematics: Linear algebra			
Code	V05G301V01102			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	González Rodríguez, Ramón			
Lecturers	González Rodríguez, Ramón Martín Méndez, Alberto Lucio			
E-mail	rgon@dma.uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The subject Linear Algebra is taught in the first four-month period of the first course of the Grado en Ingeniería de Tecnologías de Telecomunicación, with the main objective of providing students with a clear understanding of the complex numbers, systems of linear equations and elementary techniques of matrix algebra as well as an introduction to the fundamental concepts of Vector Spaces which will be needed in later subjects. Special attention will be paid to the applications of Linear Algebra.			

Training and Learning Results	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C1	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations; numerical methods, numerical algorithms, statistics and optimization
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject	Training and Learning Results		
Skill development the basic operations of matrix algebra.	B3 B4	C1	D2 D3
Knowledge of numerical methods for solving systems of linear equations and knowledge of the basic concepts involving vector spaces and linear maps.	B3		D3
Knowledge of the properties of vector spaces with inner product.		C1	
Skill development some applications of linear algebra: the method of least squares, singular value decomposition and classification of quadratic forms	B3	C1	D3
To know the arithmetic of complex numbers.	B3 B4	C1	D2 D3

Contents	
Topic	
Topic 1. Complex numbers.	Operations with complex numbers. Geometric concepts associated with complex numbers. Euler's formula and its consequences.
Topic 2. Matrices and determinants.	Matrix operations: addition, scalar multiplication and product of matrices. Matrix inverse. Block matrices. Determinants.
Topic 3. Systems of linear equations.	Systems of linear equations. Elementary row operations and Gauss method. Numerical methods for systems of linear equations.
Topic 4. Vector spaces and linear transformations.	Linear independence. Subspaces. Basis. Dimension. Rank of a system of vectors. Introduction to linear transformations. Matrix of a linear transformation.

Topic 5. Matrix diagonalization.	Eigenvalues and eigenvectors. Eigenspace. Matrix diagonalization and diagonalizable matrices.
Topic 6. Spaces with inner product and applications	Spaces with inner product. Orthogonallity. Gram-Schmidt Method. Ortogonal and unitary Diagonalization. Singular value decomposition. Matrix rank reduction. The method of least squares. Quadratic forms.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	2	2	4
Lecturing	46	69	115
Problem solving	9	9	18
Problem and/or exercise solving	3	5	8
Essay questions exam	3	2	5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practical	Solving assigned exercises and model problems. Use of the computer tool MATLAB. Through this methodology the competences B3, B4, C1, D2 and D3 are developed.
Lecturing	Explanation and development by the teacher of the contents of the various topics in the syllabus. Through this methodology the competences B3, C1 and D3 are developed.
Problem solving	Resolution by part of the professor of suitable exercises adapted to each topic. The students will also have to take part in the resolution of exercises in order to strengthen their knowledge. Through this methodology the competences B3, B4, C1, D2 and D3 are developed.

Personalized assistance

Methodologies	**Description**
Problem solving	Personalized tutoring will be available from all the teachers of the subject. For request or consult tutorials, the student can access the corresponding link in https://moovi.uvigo.gal/login/index.php
Laboratory practical	Personalized tutoring will be available from all the teachers of the subject. For request or consult tutorials, the student can access the corresponding link in https://moovi.uvigo.gal/login/index.php
Lecturing	Personalized tutoring will be available from all the teachers of the subject. For request or consult tutorials, the student can access the corresponding link in https://moovi.uvigo.gal/login/index.php
Tests	**Description**
Problem and/or exercise solving	Personalized attention will be available for assistance in the revision of tests and exams. For request or consult tutorials, the student can access the corresponding link in https://moovi.uvigo.gal/login/index.php

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	Continuous evaluation consists in three tests to be given in the class hour. The planning will be the following: 1. Exam of topic 1 and 2. 2. Exam of topic 3 and 4. 3. Exam of topic 5 and 6. Each test will have a weight of 20% in the final grade. The total weight of the continuous evaluation in the final grade will therefore be of 60%. The planning of the different intermediate evaluation tests will be approved in an Academic Commission of Degree and it will be available at the beginning of the semester.	60	B3 B4	C1
Essay questions exam	A written exam, with a maximum duration of three hours, of topics 1, 2, 3, 4, 5 and 6 at the end of the semester in date, time and venue determined in the official exams calendar of the School.	40	B3 B4	C1

Other comments on the Evaluation

Ordinary assessment:

Continuous assessment:

The final grade is calculated by the formula:

$$M = (2 \times (E1 + E2 + E3) + 4 \times EF) / 10$$

where E1, E2 and E3 are the points, in a scale 0 to 10, obtained in the three tests of the continuous evaluation and where EF represents the points, in a scale 0 to 10, obtained in the final exam. Before doing each test, the procedure and date of revising the grading of that test will be announced. After the test, the grades will be announced in a reasonable amout of time. If a student, for any circumstance, cannot attend a particular test on the date for which it is scheduled, he or she will miss that test and it will not be repeated.

The points obtained in the tests of continuous evaluation will be valid only for the academic year in which they are obtained.

It will be considered that a student has chosen to follow the continuous evaluation if he takes the second exam, that is, that of topics 3 and 4.

Global assessment**:**

The students who do not choose to be graded by continuous evaluation, will be graded by means of a final exam of all the topics of the subject. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

Extraordinary exam:

The students who at the end of the semester do not obtain a passing grade will have the opprtunity of writing a second final exam on date, time and venue determined in the official exams calendar of the School. This exam will cover topics 1, 2, 3, 4, 5 and 6 and it will be graded in a scale of 10 points and the passing grade cutoff will be 5.

Remark: During the exam correction period some students could be contacted by phone or telematically by the teacher to clarify aspects of their answers; in that case, such answers may have an impact on the exam grade.

"No presentado":

A student will obtain a grade of "No Presentado" in the ordinary exam if that student did not attend neither the continuous evaluation nor the final exam.

A student will obtain a grade of "No Presentado" in the second edition of the final grades if and only if that student obtained "No Presentado" in the first call and did not attend the second final exam.

End-of-program exam:

The students which attend the end-of-program exam will write an exam covering topics 1, 2, 3, 4, 5 and 6 which will be graded in a scale of 10 points and the passing grade cutoff will be 5.

Ethical Behavior:

It is expected a correct and ethical behavior of all students in all written tests and exams, which are meant to truly reflect the knowledge and abilities attained by each studen. Any unethical behavior detected in a particular test (such as copying or using prohibited material) will result in a grading of 0 in that test and the issue of the corresponding report for the School Director's Office.

English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

Sources of information

Basic Bibliography

R. González Rodríguez, **Álxebra Linear: Historia, Teoría e práctica**, 978-84-8158-9191-1, Servizo de Publicacións da Universidade de Vigo, 2021

D. C. Lay, **Álgebra lineal y sus aplicaciones**, 3ª, Pearson Educación, 2007

L. Merino; E. Santos, **Álgebra lineal con métodos elementales**, 1ª, Paraninfo, 2006

Complementary Bibliography

J. de Burgos, **Álgebra lineal y geometría cartesiana**, 2ª, McGraw-Hill/Interamericana de España, S. A. U., 2000

D. Poole, **Álgebra lineal: Una introducción moderna**, 2º, Cengage Learning Editores S.A., 2006

Recommendations

Subjects that continue the syllabus

Physics: Analysis of Linear Circuits/V05G301V01108
Mathematics: Calculus 2/V05G301V01106
Physics: Fields and Waves/V05G301V01202

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 1/V05G301V01101

IDENTIFYING DATA

Physics: Fundamentals of Mechanics and Thermodynamics

Subject	Physics: Fundamentals of Mechanics and Thermodynamics			
Code	V05G301V01103			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Schiussi , Stefano			
Lecturers	Fernández Doval, Ángel Manuel Schiussi , Stefano			
E-mail	schiussi@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Introduction to the basic concepts on the general laws of Mechanics and Thermodynamics as well as to their application to the resolution of problems in engineering. "English Friendly" subject. International students may request from the lecturers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) tests and assessments in English.			

Training and Learning Results

Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B5	CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area.
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
C3	CE3/FB3: Comprehension and command of basic concepts about the general laws of mechanics, thermodynamics, electromagnetic fields and waves and electromagnetism and their application to solve Engineering problems.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Understanding and mastering of the basic concepts on the general laws of Mechanics and of Thermodynamics.	B3	C3	
Ability to use the basic instrumentation to measure physical quantities.	B3 B5 B6	C3	D3
Ability to evaluate experimental data.	B3 B5	C3	
Ability to solve the elementary technical problems in engineering.	B3	C3	

Contents

Topic	
1.- Physical quantities and units. The International System.	(*)
2.- Vectorial tools for Mechanics.	(*)
3.- Point Kinematics.	(*)
4.- Point Kinetics.	(*)
5.- Statics.	(*)
6.- Oscillations.	(*)
7.- Wave motion.	(*)
8.- Zero principle of Thermodynamics. Temperature.	(*)
9.- First principle of Thermodynamics.	(*)
10.- Second principle of Thermodynamics.	(*)

Lab 1.- Measurement instruments. Error and uncertainty. Estimation of uncertainties in direct measurements.	(*)
Lab 2.- Measurement of the reaction time to a given stimulus. Measurement of the gravitational acceleration by means of a pendulum. Estimation of uncertainty in indirect measurements.	(*)
Lab 3.- Verification of Hooke's Law. Linear fit.	(*)
Lab 4.- Longitudinal and transversal standing waves. Measurements by linearization of non-linear relations and linear fit. Graphical representation of measurement results.	(*)
Lab 5.- Simple harmonic motion. Free standing oscillation of a spring. Measurements by linearization of non-linear relations and linear fit. Graphical representation of measurement results.	(*)

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	34	62
Problem solving	21	40	61
Laboratory practical	9	13	22
Essay questions exam	0.5	0	0.5
Problem and/or exercise solving	3.5	0	3.5
Report of practices, practicum and external practices	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Prior personal work: -Preliminary reading of the proposed bibliography on the subject. During the lectures: -Presentation of theoretical concepts. -Application of the theoretical concepts to simple cases and situations. -Experimental demonstrations. -Audiovisual presentations. Ulterior personal work: -Revision of theoretical concepts. -Solving of questions and exercises from the bibliography. -Consult the bibliography. -Identification of weak points which require tutorial aid. Through this methodology, competencies B3, C3, B5, B6 are worked out.
Problem solving	Solving of average-difficulty problems involving one or more theoretical concepts. During the lectures: -Presentation of solving strategies and techniques by solving example-problems. Personal work: -Solving of problems from the bibliography. -Identification of weak points which require tutorial aid. Through this methodology, competencies B3, C3, B5, B6 are worked out.

Laboratory practical	Prior personal work: -Preparation of the practical session by studying the corresponding guide and reviewing the theory. During the practical session: -Description of the experiment highlighting which theoretical concepts are involved. -Training on material and instrumentation handling. -Execution of the experiment. -Preliminary result processing. Ulterior personal work: -Processing and analysis of the results. -Weak-point identification. -Consult the bibliography. Through this methodology, competencies B3, C3, B5, B6 and D3 are worked out.

Personalized assistance

Methodologies	Description
Lecturing	Questions will be solved by the lecturers in their respective tuitional-aid time. Tutoring sessions will be held: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail (see https://moovi.uvigo.gal) or in person at the beginning or end of a lecture.
Problem solving	Questions will be solved by the lecturers in their respective tuitional-aid time. Tutoring sessions will be held: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail (see https://moovi.uvigo.gal) or in person at the beginning or end of a lecture.
Laboratory practical	Questions will be solved by the lecturers in their respective tuitional-aid time. Tutoring sessions will be held: individually or in small groups (typically of two or three students), by appointment to the corresponding lecturer (unless stated otherwise) and, preferably, in the place and timetable of the corresponding lecturer which will be published at the beginning of the semester. The appointment shall be arranged either by e-mail (see https://moovi.uvigo.gal) or in person at the beginning or end of a lecture.

Assessment

	Description	Qualification	Training and Learning Results	
Essay questions exam	Solving of questions related to the theoretical concepts of the topics in both the classroom and laboratory syllabi.	10	B3 B5 B6	
Problem and/or exercise solving	(Problem solving) Solving of simple exercises related to the theoretical concepts of the topics in the syllabus. Solving of problems involving one or more theoretical topics.	70	B3 B5 B6	C3
Report of practices, practicum and external practices	Execution of real and simulated measurements. Real- and simulated-measurement result processing.	20	B3 B5 B6	D3

Other comments on the Evaluation

(This is a translation, in case of any discrepancy or dispute, the original Spanish version shall prevail.)

The common assessment and grading rules of the University of Vigo are established in:

[RAUV] "Regulamento sobre a avaliación, a cualificación e a calidade da docencia e do proceso de aprendizaxe do estudantado" (available only in Galician language at https://secretaria.uvigo.gal/uv/web/normativa/public/show/565).

Each student summoned to an assessment test must appear with an original official document proving their identity (DNI, NIE, passport, university card or Spanish driving licence). [RAUV Art.28.4].

In the event that a fraudulent action is detected in the performance or revision of any of the assessment tests (copying, plagiarism, impersonation, introduction or use of means not permitted by the rules and instructions of the exercises and

assessment tests, alteration, subtraction or destruction of the same, etc.) [RAUV Art.42]:

- The person(s) involved shall be identified and immediately expelled from the assessment test.

- A final grade of zero points (fail) will be assigned to the person(s) involved.

- A report will be submitted to the school management for disciplinary action to be taken.

1. ORDINARY ASSESSMENT OPPORTUNITY

1.1. INTERMEDIATE CONTINUOUS ASSESSMENT TESTS

The schedule of the intermediate assessment tests will be made available by the beginning of the semester in which this subject is taught. These intermediate tests are not recoverable, i.e., they can be only taken in the scheduled dates.

The assessment tests that the student has not taken will be graded with 0 (zero points).

The corrected exercises may be revised, by requesting a tutoring session from the corresponding lecturer, during the fourteen days following the date of publication of the marks.

There will be four intermediate tests:

1.1.1 CONTINUOUS ASSESSMENT EXAMS (EC1 and EC2)

Written exams with questions, exercises and problems (marks EC1 and EC2 between 0 and 2,5 points for each exam). Duration: nominally 1 hour in one lecture on theory or problems.

1.1.2 EVALUATED LABORATORY PRACTICES (LC1 and LC2)

Experimental laboratory exercises comprising the execution of actual measurements and the processing of the results, consisting in taking an experimental laboratory class, individually processing (during the last 30 minutes) the assessable results which will be specified in the corresponding experiments guide and handing them in at the end of the class (marks LC1 and LC2 between 0 and 1 point for each of the exercises).

1.2. FINAL EXAMINATION

Written exam with three optional parts:

E12F)

-Questions, exercises and problems corresponding to the contents of EC1 and EC2 (mark E12F between 0 and 4 points).

-If a student does not take this part, the E12F mark will be assigned the sum of the EC1 and EC2 marks.

E3F)

-Questions, exercises and problems (E3F mark between 0 and 4 points).

-If a student does not take this part, it will be graded with 0 (zero points).

LF)

-Laboratory problem comprising the execution of real or simulated measurements and the processing of the results (LF mark between 0 and 2 points).

-If a student does not take this part, the LF mark will be assigned the sum of the LC1 and LC2 marks.

Duration 4 hours on the place and date officially assigned for the subject in the examinations schedule of the Centre.

1.3. FINAL GRADING OF THE ORDINARY ASSESSMENT OPPORTUNITY

A student who does not take any of the three parts of the final examination (§1.2) will be regarded as "not presented" to the ordinary assessment opportunity.

A combined mark CCF will be calculated as the sum of the marks of the three parts of the final examination (§1.2).

The final grade FINAL_F will be the lower of 10 points and CCF.

CCF = E12F+E3F+LF

FINAL_F = min{CCF, 10}

2. EXTRAORDINARY ASSESSMENT OPPORTUNITY

2.1. RESIT EXAMINATION

Written exam with three optional parts:

E12R)

-Questions, exercises and problems corresponding to the contents of E12F (mark E12R between 0 and 4 points).

-If a student does not take this part, the E12R mark will be assigned the E12F mark.

E3R)

-Questions, exercises and problems (E3R mark between 0 and 4 points).

-If a student does not take this part, the E3R mark will be assigned the mark obtained in E3F.

LR)

-Laboratory problem comprising the execution of real or simulated measurements and the processing of the results (LR mark between 0 and 2 points).

-If a student does not take this part, the LR mark will be assigned the LF mark.

Duration 4 hours on the place and date officially assigned for the subject in the examinations schedule of the Centre.

2.2. FINAL GRADING OF THE EXTRAORDINARY ASSESSMENT OPPORTUNITY

A student who does not take any of the three parts of the resit examination (§2.1) will be regarded as "not presented" to the extraordinary assessment opportunity.

A combined mark CCR will be calculated as the sum of the marks of the three parts of the resit examination (§2.1).

The final grade FINAL_R will be the lower of 10 points and CCR.

CCR = E12R+E3R+LR

FINAL_R = min{CCR, 10}

3. END-OF-PROGRAM CALL

3.1. END-OF-PROGRAM EXAMINATION

Written exam with:

-Questions

-Exercises

-Problems

-Laboratory problems (with real or simulated measurements and processing of the results)

FINAL_E mark between 0 and 10 points.

Duration 3 hours on the place and date officially assigned for the subject in the examinations schedule of the Centre.

3.2. FINAL GRADING OF THE END-OF-PROGRAM CALL

The final grade FINAL_E will be the one obtained in the end-of-program examination (§3.1).

4. CALCULATIONS AND ROUNDING:

I) All of the aforesaid calculations to obtain the marks will be performed with a resolution equal to or better than one hundredth of a point (0,01 point).

II) The final marks will be rounded to the nearest multiple of 0,1 point (one tenth of a point); if the two nearest multiples of 0,1 point are equidistant, the overall grade will be rounded to the higher of them.

III) The minimum final grade required to pass the course is 5,0 points. [RAUV Art.31]

Sources of information

Basic Bibliography

H.D. Young y R.A. Freedman, **Sears-Zemansky. Física Universitaria**, 9, 11, 12 o 13, Addison-Wesley,

H.D. Young y R.A. Freedman, **University Physics**, 9, 11, 12 or 13, Addison-Wesley,

Present and past lecturers of this subject, **Laboratory Notes for the practical sessions of**, 2023-2024, 2023

Profesorado presente y pasado de la asignatura., **Guiones de las prácticas de «Física Fundamentos de Mecánica y Termodinámica»**, 2022-2024, 2023

Bureau Internationale des Poids et Mesures (BIPM), **SI Brochure: The International System of Units (SI)**, 9, Bureau Internationale des Poids et Mesures (BIPM), 2019

Oficina Internacional de Pesas y Medidas (BIPM), **Sistema Internacional de Unidades SI**, 9, Centro Español de Metrología, 2019

Complementary Bibliography

I.N. Bronshtein, K.A. Semendiaev, **Manual de Matemáticas para Ingenieros y Estudiantes**, (cualquier edición), MIR,

Raymond A. Serway, John W. Jewett, **Física, Tomo 1**, 3, Thomson, 2003

Paul A. Tipler, **Física, Tomo 1**, 5, Reverté, 2005

W. Edward Gettys, et al., **Física Clásica y Moderna**, Mc Graw-Hill, 1991

Douglas C. Giancoli, **Física para universitarios, Tomo 1**, 3, Prentice-Hall, 2002

Marcelo Alonso, Edward J. Finn, **Física**, Addison-Wesley, 1995

Susan M. Lea, John R. Burke, **Física. La naturaleza de las cosas, Tomo 1**, Paraninfo, 2001

Ambler Thompson, Barry N. Taylor, **NIST Special Publication 811, «Guide for the Use of the International System of Units (SI)»**, 2008, National Institute of Standards and Technology, 2008

Comité Conjunto para las Guías en Metrología (JCGM), **Vocabulario Internacional de Metrología (VIM)**, 3, Centro Español de Metrología, 2012

Joint Commitee for Guides in Metrology (JCGM), **International vocabulary of metrology (VIM)**, 3, Bureau International des Poids et Mesures, 2012

Recommendations

Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101

Other comments

To adequately follow this subject, it is highly advisable to master the contents of high-school subjects on Mathematics and Physics.

IDENTIFYING DATA				
Business: Company Fundamentals				
Subject	Business: Company Fundamentals			
Code	V05G301V01104			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	González Vázquez, Beatriz			
Lecturers	González Vázquez, Beatriz Urgal González, Begoña			
E-mail	bgonza@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The objective of this subject is to make known the organisation, management and institutional framework of the company. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
B8	CG8: To know and apply basic elements of economics and human resources management, project organization and planning, as well as the legislation, regulation and standarization in Telecommunications.
C5	CE5/FB5: The necessary knowledge of business concepts, of law and institutional frameworks. business organization and management .
D2	CT2 Understanding Engineering within a framework of sustainable development.

Expected results from this subject	Training and Learning Results		
To establish guidelines on the metrics and indicators that will be used to allow the managers the evaluation and monitoring the company.	B4 B8	C5	D2
Control the start-up and to propose improvement solutions.	B8	C5	D2
Manage the requirements and the products to reduce the time of realisation of the tasks, and improve the coherence and the precision in the business management	B8		

Contents	
Topic	
UNIT 1: INTRODUCTION TO BUSINESS ADMINISTRATION	1.1. The concept of firm. 1.2. Main objectives of a business firm. 1.3. Business ownership and types of companies. 1.4. The company as a system. 1.5. Business environment. 1.6. Information and communication technologies.
UNIT 2: ECONOMIC AND FINANCIAL STRUCTURE OF THE COMPANY	2.1. Economic anf Financial Structure of the company 2.2. Working capital analysis 2.3. Operating cycle and cash conversion cycle
Unit 3: THE RESULTS OF THE COMPANY AND THE BUSINESS STRATEGY	3.1. The results of the company 3.2. Profitability and competitive strategy 3.3. Solvency and liquidity
UNIT 4: THE INVESTMENT IN THE COMPANY	4.1. Concept of investment 4.2. Classes of investments 4.3. Criteria for the evaluation and selection of investments: static and dynamic
UNIT 5: FINANCIAL OF THE COMPANY	5.1. Concept of source of finance 5.2. Types of sources of finance

UNIT 6: OPERATION MANAGEMENT (PART I). GENERAL FEATURES	6.1. Functions of Operations Management. 6.2. Classification of productive processes. 6.3. The productivity: indicators of productivity. 6.4 Innovation concept and typology.
UNIT 7: OPERATION MANAGEMENT (PART II).	7.1. The costs of production. 7.2. Break-even point. 7.3. Make-or-Buy decisions. 7.4. Operational leverage. 7.5. Inventory control.
UNIT 8: MARKETING MANAGEMENT	8.1. The market. 8.2. The competition. 8.3. Marketing system. 8.4. Marketing-mix.
UNIT 9: MANAGEMENT AND ORGANIZATION	9.1. The management system. 9.2. Human Resources management.
PRACTICAL CLASSES	The practices of the subject will adjust to the contents taught in the Theory classes

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	30	41	71
Practices through ICT	24	36	60
Problem solving	4	9	13
Objective questions exam	4	0	4
Essay questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Introductory activities	On the first day of class the teaching team will try to know the students' level of the basic concepts of this subject.
Lecturing	Presentation by the professor of the contents on the subject of study, theoretical bases and / or guidelines of a work, exercise or project to be developed by the student. With this methodology, the D2 Competition; Skill C5; Knowledge B8; and Training and Learning Results A1 and A3 are worked on.
Practices through ICT	It is a kind of classes in which the students will work individually or in pairs the practical contents of the subject. Knowledge application activities will be carried out in specific situations. In this methodology, the Skill C5 and knowledge B4 and B8, as well as Training and Learning Results A1, A2 and A3.
Problem solving	Activities in which they formulate problems and/or exercises related with the matter. The student/to has to develop the more appropriate or correct solutions. In this methodology they work on Skill C5 in a practical way; knowledge B4 and B8; as well as the results of Training and Learning A1 and A2.

Personalized assistance

Methodologies	Description
Lecturing	In the master sessions, the professor will attend, guide and solve the doubts of the students about the contents addressed in the theoretical classes. Students will have the right to personalized tutorials, in the schedule established for this purpose in the teleteaching platform. These tutorials are intended to solve doubts and guide students on the development of the contents addressed both in the theoretical classes as well as in the practical classes. Likewise, constant communication will also be maintained between professors and students through the educational platform.
Practices through ICT	In the practical sessions the professor will pose diverse activities to the students. The students will resolve said activities, and will be able to pose to the professor the questions or questions that consider on the contents of the exercises or problems posed.
Introductory activities	In the first theory session, the teaching team will try to know individually the level that the students have on the most basic issues of this subject.

Assessment

	Description	Qualification	Training and Learning Results

Objective questions exam	The content of the theory and practical classes will be evaluated. (40% the first test and 20% the practices)	60	B4 B8	C5	D2
Essay questions exam	Test of all the contents of the subject developed in theory and practical classes.	40	B4 B8	C5	D2

Other comments on the Evaluation

Following the guidelines established in the degree, two evaluation systems will be offered: continuous assessment and exam-only assessment at the end of the semester. In any of the two evaluation systems, and all the Training and Learning Results, Knowledge and Skills of the subject are evaluated.

1. Continuous assessment

The qualification by the continuous evaluation system will be determined from the following tests and activities:

- Two tests. They will be carried out during the teaching period in theory classes. Each of them will constitute 40% of the final grade for the subject. The first test does not have a liberating nature, that is, each of them will deal with the contents seen up to the moment of taking the test, both in theory and practical classes.

- Practices. The tasks assigned during the practices will account for 20% of the final grade for the subject.

The dates to take the tests will be planned by the Academic Committee of Degree and will be available at the beginning of the semester. These tests are not recoverable, that is, if a student does not perform them on the stipulated day, the professor does not have the duty to repeat them (unless there is a cause of force majeure). A student will be considered to have opted for continuous assessment when participating in the second test.

Students who opt for continuous evaluation and do not pass the subject will not be able to take the final global evaluation exam in the ordinary call.

2. Global assessment

For those students who do not opt for continuous assessment, they will be offered an evaluation procedure that allows them to obtain the highest grade. This procedure will consist in a final exam that includes the contents developed in the classes of theory and practical classes.

3. About the extraordinary call

For the extraordinary call, all students will be evaluated by the global evaluation system.

4. Qualification Of Absent

A student will be considered absent if, at most, took part in the first assessment test of continuous evaluation method. In any another case, the students will be considered as submitted to the assessment and they will receive their corresponding grade.

5. About the end-of-program call

It will consist of an exam that includes the theoretical and practical contents of the subject.

Sources of information

Basic Bibliography

Pérez Gorostegui, E., **Curso de introducción a la economía de la empresa**, EDITORIAL UNIVERSITARIA RAMON ARECES, 2009

Diez-Viel, I., Martin de Castro, G., Montoro Sanchez, M.A., **Introduction to Business Administration**, S.L. CIVITAS EDICIONES, 2012

Complementary Bibliography

Barroso Castro, C. (Coord.), **Economía de la empresa**, Pirámide, 2012

García Márquez, F., **Dirección y Gestión Empresarial**, McGraw-Hill, 2013

Moyano Fuentes, J.; Bruque Cámara, S.; Maqueira Marín, J.M.; Fidalgo Bautista, F.A.; Martínez Jurado, **Administración de empresas: un enfoque teórico-práctico**, Grupo Anaya, 2011

Iborra Juan, M.; Dasi Coscollar, A.; Dolz Dolz, C.; Ferrer Ortega, C.., **Fundamentos de dirección de empresas. Conceptos y habilidades directivas**, Paraninfo, 2014

Recommendations

Other comments

Students must attend a conference related to the topic of Human Resources that will be announced well in advance.

IDENTIFYING DATA

Programming I

Subject	Programming I			
Code	V05G301V01105			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Rodríguez Hernández, Pedro Salvador			
Lecturers	Caeiro Rodríguez, Manuel García Duque, Jorge González Castaño, Francisco Javier López Bravo, Cristina Mikic Fonte, Fernando Ariel Rodríguez Estévez, Judith Soledad Rodríguez Hernández, Pedro Salvador Sousa Vieira, Estrella			
E-mail	pedro.rodriguez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The aim of the course is to provide students with basic skills to program in a high level language. The programming paradigm followed is that of "structured programming". English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
B9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
C6	CE6/T1: The ability to learn independently new knowledge and appropriate techniques for the conception, development and exploitation of telecommunication systems and services
C12	CE12/T7: The knowledge and use of basics in telecommunication networks, systems and service programming.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D4	CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Express the solution of a simple problem by means of algorithms using top-down design.		C12	
Identify the data needed to solve a problem and associate them with appropriate datatypes based on their features (size, range, associated operators)		C12	
Code simple algorithms using the basic types of statements: assignment, selection and iteration.		C12	
Declare and define functions with a proper use of parameters.		C12	
Handle I/O operations and file management.		C12	
Define and use structured data types.		C12	
Define and manage dynamic data structures (lists, stacks, queues and trees).		C12	
Create modules and library functions and use them in programs.		C6 C12	
Predict the result of a sequence of statements, knowing the input data.		C12	
Handle basic tools in an integrated development environment: text editor, compiler, linker, debugger and documentation tools.		C6	
Develop a small scale project following all the phases: requirements analysis, design, implementation, testing and documentation.	B4 B9	C6 C12	D2 D4

Contents	
Topic	
Lecture 1: The algorithm and the programming languages.	1. A computer□s structure and operation 2. How the program gets into the computer 3. C Programming language 4. The process of developing programs 5. Simple Programming Examples 6. Software engineering concepts
Lecture 2: Grammar and basic elements of C language.	1. Basic elements of a C program 2. Identifiers 3. Expressions 4. Declaration and initialization 5. The assignment statement 6. Formatted input/output
Lecture 3: Iteration and selection statements	1. Control statements 2. Decision statements: (a) if statement (b) if-else statement (c) switch statement 3. Iteration statements: (a) do-while statement (b) while statement (c) for statement 4. Statements for altering the control flow: break and continue statements
Lecture 4: Arrays and pointers	1. Data Structures 2. Arrays: (a) One-dimensional arrays (b) Two-dimensional arrays 3. Strings 4. Copy of arrays
Lecture 5: Functions	1. Function declaration and definition 2. Functions with no parameters 3. C inter function communication: local, global and static variables 4. Functions with parameters by value
Lecture 6. Pointers	1. Pointers 2. Pointer arithmetic 3. Dynamic memory allocation 4. Arrays and pointers 5. Pointers to pointers 6. Functions with parameters by reference 7. Command line arguments
Lecture 7: Files	1. Introduction: Types of files 2. Text files in C 3. Declaration 4. File opening and closing 5. File management 6. Operations on characters 7. Operations on strings 8. Formatted operations
Lecture 8: Structured type variables	1. Introduction: Structured data types 2. struct type. Declaration 3. struct type. Operations 4. Pointers and struct type 5. struct as parameters 6. Creation of data types
Lecture 9: Lists	1. Introduction: the need for dynamic data structures 2. Dynamic data structures 3. Linked lists (a) Types (b) Most common operations

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Lecturing	24	24	48
Laboratory practical	30	20	50
Laboratory practice	4	20	24
Objective questions exam	2	18	20
Problem and/or exercise solving	1	5	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies
Description

Introductory activities	Introduction to theoretical and practical activities.
Lecturing	Professors present the main theoretical contents related to the subject These sessions can include the development of works and programs by the students. Through this methodology the competencies CE12 and CT2 are developed.
Laboratory practical	During the first part of the term the student codifies, compiles and documents simple programs guided by the instructor. In this laboratory, the Ubuntu Linux operating system and the gcc compiler will be used. Some of these activities can require the submission of a report in order to be evaluated. Through this methodology the competencies CG4, CG9, CE6, CE12, CT2, and CT4 are developed.

Personalized assistance

Methodologies	Description
Lecturing	The professors will provide individual attention to the students along the term, solving their doubts and questions. Questions will be answered during the master sessions or during tutorial sessions. The professors will establish timetables for this purpose at the beginning of the term. This schedule will be published on the subject website. Tutorial sessions could also be agreed by appointment. The tutorial schedule of the professors is avaliable in their Moovi profiles: https://moovi.uvigo.gal/user/view.php?id=11584 https://moovi.uvigo.gal/user/view.php?id=11583 https://moovi.uvigo.gal/user/view.php?id=11622 https://moovi.uvigo.gal/user/view.php?id=59589 https://moovi.uvigo.gal/user/view.php?id=35944 https://moovi.uvigo.gal/user/view.php?id=11342 https://moovi.uvigo.gal/user/view.php?id=11665 https://moovi.uvigo.gal/user/view.php?id=11299 https://moovi.uvigo.gal/user/view.php?id=11299 https://moovi.uvigo.gal/user/view.php?id=11585
Laboratory practical	The professors will provide individual attention to the students along the term, solving their doubts and questions about the laboratory practises. Questions will be answered during the lab sessions or during tutorial sessions. The professors will establish timetables for this purpose at the beginning of the term. This schedule will be published on the subject website. Tutorial sessions could also be agreed by appointment. The tutorial schedule of the professors is avaliable in their Moovi profiles: https://moovi.uvigo.gal/user/view.php?id=11584 https://moovi.uvigo.gal/user/view.php?id=11583 https://moovi.uvigo.gal/user/view.php?id=11622 https://moovi.uvigo.gal/user/view.php?id=59589 https://moovi.uvigo.gal/user/view.php?id=35944 https://moovi.uvigo.gal/user/view.php?id=11342 https://moovi.uvigo.gal/user/view.php?id=11665 https://moovi.uvigo.gal/user/view.php?id=11299 https://moovi.uvigo.gal/user/view.php?id=11299 https://moovi.uvigo.gal/user/view.php?id=11585

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practice	The student will take 2 midterm laboratory tests consisting in the development of small programs on the computer. Each of these tests will assess the student's progress on a portion of the laboratory practical exercises. The final laboratory test will assess the student's progress on the practical exercises as a whole.	50	B4 B9	C6 C12	D2 D4
Objective questions exam	The student will take 1 midterm theoretical test that may consist of: - short answer questions - multiple choice questions This exam will assess individually the student's mastery of the concepts introduced in the lecture sessions. The final theoretical exam will also contain this type of questions.	40	B4	C12	
Problem and/or exercise solving	The theoretical exams will have a part consisting of problem and/or exercise solving	10	B4	C12	

Other comments on the Evaluation

Following the guidelines specific to the degree program, each student will have 2 opportunities (the **ordinary** and **extraordinary** calls) to pass the course.

Furthermore, in the ordinary call, there will be 2 evaluation procedures (**continuous** and **global**).

ASSESSMENT TESTS

Throughout the semester, several intermediate assessment tests will be given. Specifically, there will be two **Midterm LaboratoryTests** (PL1 and PL3) and one **Midterm TheoreticalTest** (PT2). The schedule of the different intermediate assessment tests will be approved by the Academic Degree Committee (CAG) and will be available at the beginning of the semester.

During the regular examination period of the School, the **Final Theoretical Test** (ETF) and the **Final Laboratory Test** (EFL) will be given.

During the extraordinary examination period of the School, the **Extraordinary Theoretical Test** (ETX) and the **Extraordinary Laboratory Test** (EXL) will be given.

Each theoretical test may include short-answer and/or multiple-choice questions, as well as problem-solving and/or exercise resolution questions. It assesses students' knowledge of the content covered in the lectures.

All the practical exercises are mandatory. Prior to each laboratory test, it will be necessary to have uploaded to Moovi all the corresponding assignments for that test. Each laboratory test consists of making modifications to the submitted practical exercises. It evaluates those submitted practical exercises.

ORDINARY CALL

Each student taking this course may choose between the 2 evaluation procedures: continuous assessment and global assessment.

Taking the second midterm test (PT2) will be interpreted as the decision to choose continuous assessment. No taking it will be interpreted as the decision to choose global assessment.

CONTINUOUS ASSESSMENT

The condition for passing the course using the continuous assessment procedure is obtaining a final grade (NFC) equal to or higher than 5.

The final grade for continuous assessment will be calculated as the weighted arithmetic mean of the midterm and final test grades. It will be given by the following expression:

NFC = 0.6 NPP + 0.2 ETF + 0.2 EFL

Where:

NPP is the Midterm Test Grade, calculated as the weighted arithmetic mean of all midterm tests, according to the following expression:

NPP = (1PL1 + 3PT2 + 2*PL3) / 6

ETF is the grade obtained on the Final Theoretical Test.

EFL is the grade obtained on the Final Laboratory Test.

A minimum grade of 2.5 points will be required in the three components of this grade (NPP, ETF, and EFL). If the student fails to reach this minimum in any of them, the final grade for continuous assessment will be at most 4.0 (Fail).

Continuous assessment consists of the tests detailed in this guide, which are not recoverable. In other words, if a student cannot complete them within the specified timeframe, the teaching staff is not obliged to repeat them.

Before each test, the date and procedure for reviewing the grades will be indicated. Students will have the option to know the grade of each test and review the correction within approximately 2 weeks.

GLOBAL ASSESSMENT

The condition for passing the course using the global assessment procedure is obtaining a final grade (NFG) equal to or higher than 5.

This method will consist of the same final tests as the continuous assessment, although with different weights. The final

grade for global assessment will be given by the following expression:

NFG = (ETF + EFL) / 2

A minimum grade of 2.5 points will be required in the two components of this grade (ETF and EFL). If the student fails to reach this minimum in any of them, the final grade for global assessment will be at most 4.0 (Fail).

Each student taking the final tests for the course will have both grades calculated: the final grade for continuous assessment (NFC) and the final grade for global assessment (NFG). The higher of the two grades will be awarded as the final grade in the ordinary call.

The grade will be "No-show" if the student does not attend any test after the first Midterm Test (PL1).

EXTRAORDINARY CALL

Each student who does not pass the course in the ordinary call will have a second opportunity.

In the extraordinary call, the condition for passing the course is obtaining a final grade (NFX) equal to or higher than 5.

The final grade in the extraordinary call will be given by the following expression:

NFX = (NTX + NXL) / 2

Where:

NTX is the Extraordinary Theoretical Grade: if the student takes the Extraordinary Theoretical Test, NTX will be the grade obtained in that test:

NTX = ETX

If not, NTX will be the theoretical grade obtained in the ordinary call:

NTX = 0.6 PT2 + 0.4 ETF

NXL is the Extraordinary Laboratory Grade: if the student takes the extraordinary Laboratory Test, NXL will be the grade obtained in that test:

NXL = EXL

If not, NXL will be the laboratory grade obtained in the ordinary call:

NXL = 0.2 PL1 + 0.4 PL2 + 0.4 EFL

A minimum grade of 2.5 points will be required in the two components of this grade (NTX and NXL). If the student fails to reach this minimum in any of them, the final grade in the extraordinary call will be at most 4.0 (Fail).

END-OF-PROGRAM TEST

Following the guidelines specific to the degree program, students who have 3 or fewer courses remaining to graduate will have end-of-program test call in those courses.

In the end-of-program test call, the condition for passing the course is obtaining a final grade (NFX) equal to or higher than 5.

In this call, a test with short-answer and/or multiple-choice questions, as well as problem-solving and/or exercise resolution questions, will be conducted (End-of-program Theoretical Test, ETZ), and a laboratory test evaluating the lab work (End-of-program Laboratory Test, ELZ). The final grade in the end-of-program test call will be given by the following expression:

NFZ = (ETZ + ELZ) / 2

A minimum grade of 2.5 points will be required in the two components of this grade (ETZ and ELZ). If the student fails to reach this minimum in any of them, the final grade in the end-of-program test call will be at most 4.0 (Fail).

The grade obtained in any of the assessable tasks will be valid only for the academic year in which they are performed, meaning that no grade is carried over from one year to the next.

If plagiarism is detected on any of the assignments/tests, the grade will be Fail (0), and the teaching staff will report the incident to the School's administration for appropriate action to be taken.

The use of generative artificial intelligence (GAI) is permitted in the completion of academic activities for this subject. Its use must be ethical, critical, and responsible. If GAI is used, any results it provides should be critically evaluated, and any generated citations or references must be carefully verified. Additionally, it is recommended to disclose the tools used.

Sources of information

Basic Bibliography

Brian W. Kernighan, Dennis M. Ritchie, **The C Programming Language**, 1995, Prentice Hall, 1983

Brian W. Kernighan, Dennis M. Ritchie, **El Lenguaje de Programación C**, 1995, Prentice Hall, 1983

Manuel Caeiro Rodríguez, Enrique Costa Montenegro, Ubaldo García Palomares, Cristina López Bravo, J, **Practicar Programación en C**, 2014,

Complementary Bibliography

Ignacio Alvarado Aldea, Jose María Maestre Torreblanca, Carlos Vivas Venegas, Ascensión Zafra Cabeza, **100 Problemas Resueltos de Programación en Lenguaje C para Ingeniería**, 2017, Paraninfo, 2017

https://www.tutorialspoint.com/cprogramming/, **Learn C Programming**, 2021,

https://www.programiz.com/c-programming, **Learn C Programming**, 2021,

Stephen G. Kochan, **Programming in C**, 2014, Addison Wesley, 2005

Osvaldo Cairo Battistuti, **Fundamentos de Programación**, 2006, Pearson Education,

José Rafael García-Bermejo Giner, **Programación Estructurada en C**, 2008, Prentice Hall,

James L. Antonakos, Kenneth C. Mansfield Jr., **Programación Estructurada en C**, 2004, Prentice Hall, 1997

Jorge A. Villalobos S., Rubby Casallas G., **Fundamentos de Programación: Aprendizaje Activo Basado en Casos**, 2006, Prentice Hall,

Recommendations

Subjects that continue the syllabus

Informatics: Computer Architecture/V05G301V01109
Programming II/V05G301V01110

Other comments

Programming II course continues this course in the second semester of the first year.

IDENTIFYING DATA				
Mathematics: Calculus 2				
Subject	Mathematics: Calculus 2			
Code	V05G301V01106			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Álvarez Vázquez, Lino José			
Lecturers	Álvarez Vázquez, Lino José Martínez Varela, Áurea María			
E-mail	lino@dma.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The matter of Calculus II of the Degree in Engineering of Technologies of Telecommunication provides basic and common training to the branch of the telecommunication. Such as it figures in the memory of the degree, students should be able to formulate, to solve and to interpret mathematically problems within engineering of telecommunication at the end of the lectures. For this, they should know how to calculate integrals of functions of one and several variables and its meaning and they should handle the basic numerical methods of approximation for this kind of integrals. On the other hand, they should become familiar with the developments of functions in Fourier series. Also, they will have to know how to solve differential equations of first and second order. Finally, they should know to handle the Laplace transform in order to solve differential equations. All of these contents are notable for several matters that they must to study simultaneously or later in the degree.			

Training and Learning Results	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C1	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations; numerical methods, numerical algorithms, statistics and optimization
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject	Training and Learning Results		
Managing the transformation of Laplace as a tool of analysis of the linear systems.	B3 B4	C1	D2 D3
Knowledge of the necessary theoretical bases for the analysis of Fourier.	B3 B4	C1	D2 D3
Knowledge and handle of the simple techniques for the integration of ordinary differential equations.	B3 B4	C1	D2 D3
Understanding the basic theory of integration of functions of one and several variables.	B3 B4	C1	D2 D3

Contents	
Topic	
Subject 1. Integral calculus in R.	The Riemann integral: integrable functions. Fundamental theorems of the integral calculus. Computation of primitives: integration by parts and change of variable. Improper integrals.
Subject 2. Numerical methods for the approximation of integrals.	Quadrature rules of interpolating polynomial type. Properties. Interpolation error. Particular cases: Poncelet, Trapezoidal and Simpson. Composite quadrature rules.

Subject 3. Fourier series and Fourier transform.	Orthogonal functions. Fourier series. Developments of Fourier series for odd and even functions. Convergence. The Fourier transform.
Subject 4. Multiple integration.	The double and triple integrals in elementary regions. Change in the order of integration. Theorems for the change of variable. Applications.
Subject 5. The Laplace transform.	Definition of the Laplace transform. Properties.
Subject 6. Ordinary differential equations.	Generalities on the differential equations: concept of solution, families of curves and orthogonal trajectories. Differential equations of first order: existence and uniqueness of solution, exact equations, separate variables, homogeneous equations and linear equations. Differential equations of second order: existence and uniqueness of solution for linear differential equations, application of the Laplace transform, indeterminate coefficients, variation of parameters, equation of Cauchy-Euler.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	21	21	42
Laboratory practical	3	0	3
Lecturing	36	60	96
Problem and/or exercise solving	3	6	9

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Problem solving	In these hours of work the professor will solve problems of each one of the subjects and will enter new methods of solution no contained in the master classes from a practical point of view. The student also will have to solve problems proposed by the professor with the aim to apply the obtained knowledges. Through this methodology the competencies B3, B4, C1, D2 and D3 are developed.
Laboratory practical	In these practices, the computer tool MATLAB will be used to study and to apply the numerical methods of approximation of integrals described in the Theme 2 of the matter. Through this methodology the competencies B4, C1, D2 and D3 are developed.
Lecturing	The professor will expose in this type of classes the theoretical contents of the matter. Through this methodology the competencies B3, C1, D2 and D3 are developed.

Personalized assistance

Methodologies	Description
Lecturing	The professor will attend personally the doubts and queries of the students. He will solve doubts in his office, in the classes of problems, and in the laboratory. Also the Web platform Moovi and the email will be used to help the students. They will have occasion of to attend tutorial sessions in a timetable established at the beginning of the course and which will be published in Moovi (https://moovi.uvigo.gal/user/profile.php?id=11586).
Problem solving	The professor will attend personally the doubts and queries of the students. He will solve doubts in his office, in the classes of problems, and in the laboratory. Also the Web platform Moovi and the email will be used to help the students. They will have occasion of to attend tutorial sessions in a timetable established at the beginning of the course and which will be published in Moovi (https://moovi.uvigo.gal/user/profile.php?id=11586).
Laboratory practical	The professor will attend personally the doubts and queries of the students. He will solve doubts in his office, in the classes of problems, and in the laboratory. Also the Web platform Moovi and the email will be used to help the students. They will have occasion of to attend tutorial sessions in a timetable established at the beginning of the course and which will be published in Moovi (https://moovi.uvigo.gal/user/profile.php?id=11586).

Assessment

	Description	Qualification	Training and Learning Results

Problem and/or exercise solving	* Three "one hour sessions": 1st session: Themes 1, 2 and 3. 2nd session: Theme 4. 3rd session: Themes 5 and 6. These three sessions account for 60% of the score with the following weights: First: 20% (2 points) Second: 20% (2 points) Third: 20% (2 points) * One final exam: 40% (4 points) Individual assessment	100	B3 B4	C1	D2 D3

Other comments on the Evaluation

The evaluation will preferably be continuous. The student will be enrolled in this kind of assessment if he attends any evaluable session. Once enrolled, it is impossible to unsubscribe from continuous assessment.

The exams of continuous evaluation are not recoverable, ie, if a student can not attend the test in the date stipulated by the teacher, it is impossible to require the repetition. Before performing each test, both the approximate date of publication of the qualifications and the date and procedure for review them will be communicated. The score obtained at the evaluable tasks will be only valid for the academic year in which the student make them.

In tests of continuous assessment the student will solve problems and exercises of the topics of matter.

The schedule of the midterm/intermediate exams will be approved in the Comisión Académica de Grado (CAG) and will be available at the beginning of each academic semester.

1. Continuous assessment.

The final score for a student who makes continuous assessment is given by the formula

N = C + E

C: Grade obtained by adding the scores of the three sessions of the items 1, 2, 3, 4, 5 and 6.
E: Grade of the final examination of the items 4, 5 and 6.

In this mode **a student will pass the subject when N is greater than or equal to 5**.

2. Global assessment.

Those students who fail to continuous assessment may be submitted to a final exam of all topics in the subject on the same date that the final exam of continuous assessment.

These students will be evaluated from 0 to 10 points and **they will pass the subject when the obtained score is greater than or equal to 5**.

3. Extraordinary exam.

Previously to the exam students who chose continuous assessment may choose, if desired, for an exam of the items 4, 5 and 6. The final grade is obtained as

NR = C + ER

C: Grade obtained by adding the scores of the three sessions of the items 1, 2, 3, 4, 5 and 6.
ER: Grade the final recovery examination of the items 4, 5 and 6.

In this mode a student **will pass the subject when NR is greater than or equal to 5**.

If they do not choose that option, the student will be assessed in all the issues on the subject.

In this other method they will be evaluated from 0 to 10 points. A student **will pass the subject when the obtained score is greater than or equal to 5**.

4. Qualification of not presented.

Finally, a student is considered not presented **if is not enrolled in the continuous assessment and does not attend any of the examinations** of the subject. Otherwise the student is considered presented.

5. End-of-program exam.

The student will be assessed in all the issues on the subject.

Sources of information

Basic Bibliography

D. Zill - W.S. Wright, **Cálculo de una variable**, 4ª, McGraw-Hill, 2011
J.E. Marsden - A.J. Tromba, **Cálculo vectorial**, 5ª, Addison-Wesley, 2004
D.G. Zill - M.R. Cullen, **Ecuaciones diferenciales**, 3ª, Thomson, 2002

Complementary Bibliography

A. Quarteroni - F. Saleri, **Cálculo científico con Matlab y Octave**, 1ª, Springer, 2006

Recommendations

Subjects that continue the syllabus

Physics: Fields and Waves/V05G301V01202

Subjects that are recommended to be taken simultaneously

Physics: Analysis of Linear Circuits/V05G301V01108
Mathematics: Probability and Statistics/V05G301V01107

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101

IDENTIFYING DATA				
Mathematics: Probability and Statistics				
Subject	Mathematics: Probability and Statistics			
Code	V05G301V01107			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Fernández Bernárdez, José Ramón Alonso Alonso, Ignacio			
Lecturers	Docampo Amoedo, Domingo Fernández Bernárdez, José Ramón Mojón Ojea, Artemio			
E-mail	ignacio.alonso@uvigo.es jramon.fernandez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of this subject is to study some basic concepts of statistics, probability and random processes. These concepts are necessary in order to easily follow other subsequent subjects.			

Training and Learning Results	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C1	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations; numerical methods, numerical algorithms, statistics and optimization
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject	Training and Learning Results		
Learn how to distinguish between deterministic or random models	B4	C1	D2
Identify a probabilistic model that fits with the needs of a specific problem	B3 B4	C1	D2 D3
Propose solutions to simplify statistical models by using deterministic parameters	B3 B4	C1	D2 D3

Contents	
Topic	
Probability theory	Concept of probability. Axiomatic definition. Conditional probability, total probability and Bayes theorems. Independence.
One-dimensional random variables	Concept of random variable (RV). Classification. Cumulative distribution function (CDF) and properties. Discrete random variables: probability mass function. Continuous random varriables: density function. Functions of an RV. CDF and discrete RV. Transformation of continuous RVs: fundamental theorem. Mean and variance.

Random vectors	CFD and continuous RV. Marginals. Point and line masses. Conditional density. Continuous versions of Bayes and total probability theorems. Functions of two-dimensional RVs: fundamental theorem. Changes of dimension. Correlation and regression.
Estimation and limit theorems	Sample and population. Estimators. Estimation of mean and variance. Sequences of RVs. Laws of large numbers. Central limit theorem.
Stochastic processes	Description of a stochastic process. Statistics of a stochastic process. Stationarity. Examples.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	14	42
Problem solving	17	34	51
Practices through ICT	14	7	21
Problem and/or exercise solving	1	6	7
Objective questions exam	1	6	7
Essay questions exam	2	14	16
Essay	0	6	6

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The course is divided in five main topics. Each topic will have a theoretical part that will be exposed by the teacher. Students will be required to perform a previous reading of the contents. Through this methodology the competencies CG3, CE1 and CT3 are developed.
Problem solving	Each topic will be complemented with problem resolution. The problems could be developed and solved in big or small group classes. The students will be required to work previously on these problems. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.
Practices through ICT	Each topic will be completed with one or several sessions of computer practices. For this, a software developed by the teachers (based on Python) and specific questionnaires for each topic will be used. Students will be required to perform a previous reading of the contents. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Students will have the opportunity to attend one-on-one tutorials, in person or online. Each teacher, at the beginning of the term, will establish the schedule and characteristics of the offered tutorials. The contact details of the teaching staff are specified on the subject's page, on MooVi (https://moovi.uvigo.gal), within the "Teaching staff and tutorials" section.
Problem solving	Students will have the opportunity to attend one-on-one tutorials, in person or online. Each teacher, at the beginning of the term, will establish the schedule and characteristics of the offered tutorials. The contact details of the teaching staff are specified on the subject's page, on MooVi (https://moovi.uvigo.gal), within the "Teaching staff and tutorials" section.
Practices through ICT	Students will have the opportunity to attend one-on-one tutorials, in person or online. Each teacher, at the beginning of the term, will establish the schedule and characteristics of the offered tutorials. The contact details of the teaching staff are specified on the subject's page, on MooVi (https://moovi.uvigo.gal), within the "Teaching staff and tutorials" section.

Assessment

	Description	Qualification	Training and Learning Results

Problem and/or exercise solving	Students must solve a problem individually	20	B3 B4	C1
Objective questions exam	Students must answer a multiple choice test individually	25	B3 B4	C1
Essay questions exam	Individual final exam	40	B3 B4	C1
Essay	Individual submission of a problem solved independently	15	B3 B4	C1

Other comments on the Evaluation

Following the guidelines of the degree, two assessment systems will be offered to the students: Continuous assessment or Global assessment.

Each student can decide himself to follow or not Continuous assessment. It is assumed that a student follows this assessment system if he sits task 2 (around the seventh week of the term) or any later task. Sitting Task 1 (both, part 1 and part 2) does not bind the student to Continuous assessment. Even so, on the day of the final exam, the student will be able to choose Global assessment.

Students who choose Continuous assessment:

Several midterm tasks are assessed with a grade between 0 and 10. In this assessment method, the final grade will be calculated as a weighted average, with the weights specified below, of the grades of the different midterm tasks and the final exam. The schedule of the midterm tasks will be approved in the Comisión Académica de Grado (CAG) and it will be available at the beginning of each academic semester.

A brief description of the tasks and their weight in the final grade is listed below:

- Task 1: Weight 20%. Two parts, both with the same weight:
    - Part 1: Individual resolution of a problem
    - Part 2: Correction of a solution of the same problem solved by someone else
- Task 2: Individual resolution of a multiple choice test. Weight 25%
- Task 3: Submission of a problem solved individually. Once the problem has been assigned, the deadline for submission is 48 hours later. Weight 15%
- Last Task: Final exam. A reduced version of the exam to be carried out by the students who choose Global assessment. Weight 40%

Before the completion or delivery of each task, the date and procedure for its review will be indicated. Students will have the option to know the grade of each task and review its correction within a reasonable period of time (around one week).

These tasks are not recoverable, that is, if a student cannot sit them, teachers will not be committed to repeat them, unless in the case of documented justified reasons.

Throughout the course, during the classes, some exercises will be proposed. Those participating in continuous assessment and completing these exercises may receive a bonus of up to 0.5 marks. If awarded, this bonus will be added to the final grade achieved through the continuous assessment method. If the sum is higher than 10, the final grade will be 10.

The obtained grades will be valid only for the current academic course.

If a student is binded to Continuous assessment and does not pass the course he/she will receive a grade of fail, regardless of he/she sits the final exam or not.

Students who choose Global assessment or End-of-program exam:

In these cases students will just carry out a single final exam. This exam will be graded between 0 and 10, and this value will be the final grade of the student.

Extraordinary exam:

The extraordinary exam is only available for students who have not passed the subject previously and they have to choose between Continuous and Global assessment, regardless of the system they chose at the Ordinary exam. The choice has to be made when handing in the exam to the teacher. On the other hand, grades will be obtained using the corresponding assessment system as it has been described above.

The subject is considered passed if the final grade obtained is greater than or equal to 5.

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

Sources of information

Basic Bibliography

JR Fernández, I. Alonso y A. Mojón, **Apuntes de Probabilidad y Estadística**, 14 ed, 2025

JR Fernández, I. Alonso and A. Mojón, **Notes on Probability and Statistics**, 4 ed, 2025

A Mojón, I. Alonso y JR Fernández, **Vídeos de la asignatura de Probabilidad y Estadística**, 1 ed, UVigoTV, 2014

X. Rong Li, **Probability, Random Signals and Statistics**, 1 ed, CRC Press, 1999

R. Cao y otros, **Introducción a la estadística y sus aplicaciones**, 1 ed, Pirámide, 2001

Complementary Bibliography

H. Stark y J.W. Woods, **Probability, Random Processes, and estimation theory for engineers**, 2 ed, Prentice Hall, 1994

D. Peña, **Estadística, modelos y métodos. Tomo 1: Fundamentos**, 2 ed, Alianza Universidad Textos, 1991

P. Peebles, **Principios de probabilidad, variables aleatorias y señales aleatorias**, 4 ed, McGraw-Hill, 2006

A. Papoulis, **Probability, random variables and stochastic processes**, 4 ed, McGraw-Hill, 2002

A. Blasco y S. Pérez-Díaz, **Modelos aleatorios en ingeniería**, 1 ed, Paraninfo, 2015

Recommendations

Subjects that continue the syllabus

Data Communication/V05G301V01204
Computer Networks/V05G301V01210
Signal Transmission and Reception Techniques/V05G301V01208
Basics of bioengineering/V05G301V01415

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 2/V05G301V01106

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101

IDENTIFYING DATA

Physics: Analysis of Linear Circuits

Subject	Physics: Analysis of Linear Circuits			
Code	V05G301V01108			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	García-Tuñón Blanca, Inés			
Lecturers	García Mateo, Carmen García-Tuñón Blanca, Inés Gómez Araújo, Marta Pérez Eijo, Lorena María			
E-mail	inesgt@com.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The course introduces the fundamentals of the lumped circuit principles and abstractions on which the design of electronic systems is based. These include lumped circuit models for sources, resistors, inductors, and capacitors. It intends to present some techniques to analyze (to determine currents and voltages) such systems: conventional analysis (integer-differential analysis, phasors and impedances in sinusoidal regime) and linear systems theory based analysis (by using the Laplace transform). English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C4	CE4/FB4: Comprehension and command of basic concepts in linear systems and their related functions and transforms; electric circuits theory, electronic circuits, physical principles of semiconductors and logical families, electronic and photonic devices, materials technology and their application to solve Engineering problems.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
To know the elements and laws involved in lumped circuit analysis.		C4	
To show the ability to analyse linear circuits in different circumstances: -. to know how to choose among different alternatives when solving a problem. -. to know simplifying techniques, their constraints, and how to decide which ones must be used.	B4	C4	D2
To translate the time domain into the transformed domains, by using transforms basic concepts.		C4	
To be able to qualitatively justify the role played by circuit elements and their interactions.	B3	C4	D3
Handle with solvency the language and symbolism of the discipline.	B3 B4	C4	

Contents

Topic	
I: Introduction to the circuit analysis	Fundamental and derived magnitudes. Circuit elements. Kirchhoff's laws. Resistors in series. Resistor in parallel. Divider circuits: voltage-divider and current-divider.

II: Techniques of circuit analysis in steady-state continuous regime.	Analysis by the mesh current method. Analysis by the node voltage method. Source transformations. Thévenin and Norton equivalent circuits. Maximum power transfer. Superposition.
III: Reactive elements	Inductors and capacitors. Series-parallel combinations of inductors and capacitors. Inductors and capacitors in steady-state continuous regime. Transient regime. Natural and step response of RL and RC circuits.
IV: Sinusoidal steady-state analysis	Definition and parameters. Rms and medium value. Concepts of phasor and impedance. Mesh and node analysis of steady-state sinusoidal regime networks. Thévenin and Norton equivalent circuits. Ideal transformers. Power expressions and calculations.
V: Two-port circuits	Definition of a two-port circuit. Characteristic parameters. Interconnected two-port circuits. Analysis of the terminated two-port circuit.
VI: Circuit analysis in the transformed domain	Steady-state response in a circuit. The transfer function. Circuit elements in the s domain. Circuit analysis in the s domain.
VII: Frequency selective circuits	Filter concept. Low-pass filters. High-pass filters. Bandpass filters. Bandreject filters.
VIII: Circuit analysis in the time domain	Classification of signals. Classification of systems. Linear and time invariant systems. Direct and inverse Laplace Transform. Poles and zeros diagram. Response to impulse. Convolution integral.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Lecturing	24.5	49	73.5
Practices through ICT	12	12	24
Laboratory practical	8	4	12
Problem solving	9	4	13
Problem and/or exercise solving	3	9	12
Systematic observation	1	2	3
Essay questions exam	2	10	12
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Introductory activities	Presentation of the course: syllabus, bibliography, teaching methodology, and assessment and grading procedures. Through this methodology the competencies CT2 and CT3 are developed.
Lecturing	The goal of this methodology is the presentation of the theoretical contents and the practical assessment about students learning abilities. Different exercises and problems related to the specific subject will be solved during these sessions, by the Professor or the students with his/her support, either individually or working in a group. Through this methodology the competencies CG3, CG4, CE4, CT2 and CT3 are developed.

Practices through ICT	Theses sessions will consist on a supervised either individual or team problem solving of practical applications related to the theoretical content of the subject. The solutions could be analyzed, checked and compared using computational tools. Through this methodology the competencies CG3, CG4 and CE4 are developed.
Laboratory practical	Practical sessions will be carried out in the hardware lab, assembling and measuring circuits tasks will be covered. Through this methodology the competencies CG3, CG4 and CE4 are developed.
Problem solving	Theses sessions will consist on a supervised team problem solving of practical applications related to the theoretical content of the subject. Through this methodology the competencies CG3, CG4 and CE4 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Needs and study matter queries of students will be address by the professors on tutoring hours (avaliables at ttps://moovi.uvigo.gal).
Laboratory practical	Professors set the pace of the session and resolve any questions that arise during the realization of practice. Also on the schedule tutoring (avaliable at ttps://moovi.uvigo.gal)., professors address the needs and queries of the students related to laboratory practices.
Practices through ICT	Professors set the pace of the session and resolve any questions that arise during the realization of practice. Also on the schedule tutoring (avaliable at ttps://moovi.uvigo.gal)., professors address the needs and queries of the students related to practices in computer rooms.
Problem solving	Professors set the pace of the session and resolve any questions that arise during the session. Also on the schedule tutoring (avaliable at ttps://moovi.uvigo.gal)., professors address the needs and queries of the students related to problem solving.

Assessment

	Description	Qualification	Training and Learning Results
Problem and/or exercise solving	There will be 3 tests in Group A schedule: ECA1, ECA2 and ECA3. The score of each of these three tests will be 2 points. The schedule of the tests will be approved in the CAG and will be available at the beginning of the semester.	60	B3 C4 B4
Systematic observation	Throughout the course, at the end of different practical sessions (practices through ICT and laboratory practices), the subject's teaching staff will propose the resolution of some simple exercises related to the content of the session and previous sessions. Students who participate in the continuous evaluation and solve these exercises may receive a total bonus of up to 0.5 points (Bonus). The bonus received will be added to the final continuous evaluation grade and if the maximum possible grade is exceeded, the final continuous evaluation grade would be truncated by 10.	5	B3 C4 D2 B4 D3
Essay questions exam	Global Test (PG). It will cover all the contents of the subject, both theoretical and practical, and may include multiple choice tests, reasoning questions, problem solving and / or exercises, as well as the development of practical cases. There will be a version of this exam for students who follow the continuous assessment, whose maximum score will be 4 points, and another extended version of it with a score of 10 points for the rest of the students.	40	B3 C4 B4

Other comments on the Evaluation

The student, in agreement to the official academic-year schedule, will have two opportunities during the academic year to pass the course:

1. Ordinary exam at the end of the semester.

Students can freely choose the continuous assessment system described in the previous section, without this excluding the possibility of taking a final exam.

Possible cases:

- Students who only take the final exam: they are graded with the score they have obtained in it (0 to 10 points).
- Students who follow the continuous assessment: they are qualified with the sum of all the scores, truncated by 10:

Mark = min (ECA1 + ECA2 + ECA3 + Bonus + PG , 10)

2. Extraordinary exam.

Students who did not pass the course at the end of the semester can take an extraordinary final exam that will cover all the contents of the subject, both theoretical and practical, and that may include multiple choice tests, reasoning questions, problem solving and / or exercises, as well as the development of practical cases. The score achieved in it (between 0 and 10) will be the final grade.

Students whos have followed the continuous assessment may decide, on the same day of the exam, whether or not to keep their continuous assessment grade in the same way as in the first opportunity final exam.

End-of-program exam:

There will be an exam that will cover all the contents of the subject, both theoretical and practical, and that may include multiple choice tests, reasoning questions, problem solving and / or exercises, as well as the development of practical cases. The score achieved in it (between 0 and 10) will be the final grade.

Additional comments:

- Students must attend the practices in the group assigned to them at the beginning of the semester.
- All marks in the evaluation are individual.
- Taking the ECA2 or successive scoring tests and / or any of the final exams will mean that the student will have a different grade than "Not presented".
- The grade obtained in continuous evaluation will be valid only for the academic year in which it is carried out.
- The subject is considered approved if the final grade is equal to or greater than 5.

Re-scheduling of tests.

In case of missing a test, instructors have not any compulsion to rescheduling.

Test results.

Before each test, the date and revision procedure of assigned grading marks will be indicated. Such dates will imply a reasonable delay (in general, not greater than three weeks) between the date of test and the release of the grading marks.

Plagiarism.

Plagiarism is regarded as serious dishonest behaviour. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

Use of Generative Artificial Intelligence

In carrying out the academic activities of this subject, the use of generative artificial intelligence (GAI) is allowed. Its use must be carried out in an ethical, critical and responsible manner. In the case of using IAG, any results it provides should be critically evaluated, and any citations or references generated should be carefully verified. It is also recommended to declare the use of the tools used.

Sources of information
Basic Bibliography
James W. Nilsson, **Electric Circuits**, 10, PEARSON, 2014
Material docente, **Página web**, moovi.uvigo.gal,
Complementary Bibliography
J.H. McClellan, R.W. Schafer, M.A. Yoder, **Signal Processing First**, PEARSON, 2003

Recommendations
Subjects that continue the syllabus

Physics: Fundamentals of electronics/V05G301V01201
Digital Signal Processing/V05G301V01205
Signal Transmission and Reception Techniques/V05G301V01208

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 2/V05G301V01106

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101

Other comments

It is strongly recommended that students are familiar with complex numbers, trigonometric functions, linear equation system solving, elemental function derivatives and computation of simple integrals.

IDENTIFYING DATA				
Informatics: Computer Architecture				
Subject	Informatics: Computer Architecture			
Code	V05G301V01109			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Llamas Nistal, Martín			
Lecturers	Anido Rifón, Luis Eulogio Llamas Nistal, Martín Rivas Costa, Carlos Santos Gago, Juan Manuel			
E-mail	martin@uvigo.es			
Web	http://moovi.uvigo.es			
General description	Students of the degree in Engineering in Telecommunication Technologies interact with computers both as specialized users and as designers and developers of complex systems, where computers play a central role in their design and even as systems components. Hence, the motivation for a course in computer architectures is to provide students with a fundamental understanding of computer operations. For this, computers are studied at the conventional machine level, which abstracts away implementation details that will be discussed in electronics/microelectronics courses and serves as the foundation for the symbolic machine level, at which computers are programmed using high-level languages. Besides, this course provides an introduction to the operating machine level by discussing basic operating systems concept, and shows an example application of the symbolic machine level through the introduction of the Database Management Systems. This is an English Friendly course: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C2	CE2/FB2: The basic knowledge about using and programming computers, operative systems, databases and Engineering applied software.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Expected results from this subject	Training and Learning Results		
Knowledges of the main concepts related with the architecture of the computers and capacity for his handle through models.	B3		
Capacity for the handle of the systems of representation of the information used in the computers	B3		
Knowledges of the types of instructions more representative and variations more notable and capacity to determine the implications of his use by part of the programmer of conventional machine	B3 B4		
Knowledges of the main ways of addressing modes in assembler language and capacity for the efficient handling of these.	B3 B4	C2	
Acquisition of skills on the design of algorithms and the construction of programs to level of conventional machine	B3 B4	C2	D2 D3
Knowledge of the principles and fundamental components of the operating systems	B3	C2	D3
Understanding of the main functions of the operating systems	B3	C2	D3
Knowledge of the fundamental aspects of the databases.	B3	C2	D3

Understanding of the distinct models of organisation of the information in databases	B3	C2	D3
Acquisition of basic skills on the languages of query to databases	B3 B4	C2	D2 D3

Contents	
Topic	
1. Preliminaries	Information Representation in computers. von Neumann Model. Structural, procesal and functional models.
2. Von Neumann Model	Components of von Neumman machine. Simple Machine. Central Processing Unit, Arithmetic and Logic Unit, memory, registers, buses.
3. Symbolic Representation and Processing .	Representation of basic data elements: integer, character, floating point. Conventions for data storage. Processing operations. Introduction to symbolic processing. Assembler language.
4. Instructions and addressing	Instructions and addressing modes. Software considerations. Registers at the conventional machine level. Register transfer language (RT level). Instruction formats. Addressing modes. Stacks and subprograms. RISC and CISC computers.
5. RISC Computer	Instruction sets & formats. Addressing modes. Assembler. Example programs.
6. CISC Computer	Instruction sets & formats. Addressing modes. Assembler. Example programs.
7. Device Management.	Device types. Management of variety. Models. Secondary memories. Interrupts. Service Rutines. DMA: justification.
8. Parallelism and parallel Architectures	Pipelining. Parallelism and memory access. Associative Memory. Parallel architectures. Vector processors. Multiprocessors.
9. Operating systems	The operating machine. Introduction to operating systems. Definition of an operating system.
10. Databases	Introduction to the database systems. Database types.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	22	27.5	49.5
Introductory activities	5	5	10
Problem solving	10	17.5	27.5
Lecturing	12	24	36
Self-assessment	0	3	3
Laboratory practice	2	4	6
Laboratory practice	2	4	6
Problem and/or exercise solving	1	4	5
Problem and/or exercise solving	2	5	7
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Laboratory practical	The course includes programming assignments that will performed using an ARM simulator. Using this methodology, competences CG3, CG4, CT2, CT3 and CE2 are developed.
Introductory activities	Presentation of course contents, methodology, tutoring hours, evaluation, lab work, and any other issue related to the subject. Through this methodology, competences
Problem solving	Programming, information representation, and other problems and exercises will be solved at lecture time. Some will be solved by students in advance at home, and they will participate actively in the solution of additional problems. Through this methodology, competencies CG, CT2 and CE2 are developed.
Lecturing	Theoretical concepts and their practical application will be introduced during the classes. Students will be encouraged to participate by alternating lectures with problem and exercise solving. Therefore, sessions will include lectures and time for exercises and problems. Through this methodology the competencies CG3, CT3 and CE2 are developed.

Personalized assistance	
Methodologies	**Description**
Lecturing	Students will have the chance to attend tutorial sessions at the teacher´s office. Teachers will define an schedule for this purpose at the beginning of the course. This schedule will be published on the course website.

Laboratory practical	Students will have the chance to attend tutorial sessions at the teacher´s office. Teachers will define an schedule for this purpose at the beginning of the course. This schedule will be published on the course website.
Problem solving	Students will have the chance to attend tutorial sessions at the teacher´s office. Teachers will define an schedule for this purpose at the beginning of the course. This schedule will be published on the course website.

Assessment

	Description	Qualification	Training and Learning Results		
Self-assessment	Exam questions will be available for students, in order to perform self assessment.	0	B3 B4	C2	
Laboratory practice	EP1 continuous evaluation exam consisting of practical exercises at the laboratory on the part P1 of the lab syllabus.	16	B3 B4	C2	D2 D3
Laboratory practice	EP2 continuous evaluation exam consisting of practical exercises at the laboratory on the part P2 of the lab syllabus.	24	B3 B4	C2	D2 D3
Problem and/or exercise solving	ET1 continuous evaluation classroom exam consisting on questions and/or exercises, covering the part T1 of the classroom syllabus.	24	B3 B4	C2	D2 D3
Problem and/or exercise solving	ET2 continuous evaluation classroom exam consisting on questions and/or exercises, covering the part T2 of the classroom syllabus.	36	B3 B4	C2	D2 D3

Other comments on the Evaluation

ASSESSMENT

This subject is organized in two parts: Theory and Lab.

The final grade for the course (FG) is computed as the weighted average (WA) of the theory grade (TG) and Lab Grade (PG): FG = WA = 0.6 x TG + 0.4 x LG

However, if any of TG or LG is less than 3.5 and WA is greater than 4.0, then the final grade will be 4.0 or the weighted average WA of both grades, whatever is the lowest value.

To pass the course, FG must be greater than or equal than 5.0

Both parts can be evaluated by Continuous Assessment (CA) or by a Global assessment (GA), in the latter case by means of a final exam (FE).

The FE will have two parts, Theory and Lab, and will take place at the officially approved date and time.

CA will be based on the tests defined in this guide. In the case an student misses a CA test it cannot be retaken or rescheduled.

CA test grades are only valid for the current academic year, being discarded in case the student fails the course.

CLASSROOM SESSIONS / THEORY

The Theory part is divided into two sub-parts: T1 and T2. T1 corresponds to approximately half of the syllabus, while T2 covers all the syllabus.

CLASSROOM. REGULAR CALL (CONVOCATORIA ORDINARIA) ASSESSMENT

CLASSROOM. REGULAR CALL. CONTINUOUS ASSESSMENT (CA).

In the case of CA, it consists of two exams: ET1 and ET2 that correspond to the two parts in which classroom content is divided. ET1 & ET2 exam dates will be approved at a Degree□s Academic Committee (CAG) meeting and will be available at the beginning of the academic term.

Additionally, during the classroom lectures, short exercises may be proposed to be completed using your cell phone. Altogether, they can add up to one additional point to the theory grade of each part.

Thus, the grade for each part will be the one obtained in the exam (0-10 points) plus the one obtained by solving the short exercises (0-1 points).

The theory CA grade for the Regular call is TG=0.4xT1 + 0.6xT2 (i.e., the weights of T1 & T2 in the final grade are respectively 40% & 60%).

CLASSROOM. REGULAR CALL. GLOBAL ASSESSMENT

All students that have not attended CA will have to attend the Final classroom exam (FCE). The FCE consists of two exercises for T1 and T2.

The global assessment's theory grade is computed as: TG=0.4xT1 + 0.6xT2

CLASSROOM. SUPPLEMENTARY CALL (CONVOCATORIA EXTRAORDINARIA) ASSESSMENT

The Supplementary call exam has the same structure as the Regular call one.

Not attending the Supplementary Call implies accepting the grade obtained at the Regular call.

If you failed the theory part (both in CA and GA), you can:

- sit both parts (ET1 and ET2), which would supersede the theory grade obtained in CA or GA.

- sit only one of the two parts (ET1 or ET2), which would supersede the grade obtained for that part in CA or GA.

- not to take any part and keep the theory grade obtained in CE or GA.

In case of CA, the grade obtained by solving the short exercises during the classroom lectures will be kept and added to the final grade.

The theory grade will be the one computed as 0.4xT1 + 0.6xT2, with the new grades from ET1 and/or ET2, if applicable. Sitting any part (ET1 and/or ET2) implies renouncing to the previously obtained grade.

CLASSROOM. END-OF-STUDIES CALL

It will consist of an exam similar to the Final exam of the Regular call.

LAB ASSESSMENT

The lab part is carried out on an ARM/Thumb assembler. It is divided into two parts: P1 deals with about half of the syllabus and P2 the whole syllabus.

LAB. REGULAR CALL

LAB. REGULAR CALL. CONTINUOUS ASSESSMENT (CA)

The Lab's CA consists of 2 exercises EP1, EP2 that correspond to the two parts in which lab activities are divided. The EP1 exam□s date will be approved in a Degree□s Academic Committee (CAG), will take place in the afternoon and all the details will be available at the beginning of the academic term. EP2 will take place on the day of the Regular call□s GA. There will be a separate exam for those who opt for CA and for those who decide to sit the GA only.

Additionally, during the lab sessions, short exercises may be proposed to be completed using your cell phone. Altogether, they can add up to one additional point to the lab grade.

Thus, the grade for each part will be the one obtained in the exam (0-10 points) plus the one obtained by solving the short exercises (0-1 points).

The lab CA grade for the Regular call is TG=0.4xT1 + 0.6xT2

LAB. REGULAR CALL. GLOBAL ASSESSMENT

All students opting for GA will have to attend a final lab exam (FLE).

The FLE will consist of an exercise on the complete ARM/Thumb syllabus to be performed in the lab.

The lab grade in this case is the grade obtained in the FLE.

LAB. SUPPLEMENTARY CALL EXAM

The Supplementary call's exam will be similar to the GA's FLE of the Regular call. All students who did not pass the lab part, independently of them of opting for CA or not, may attend this exam. Not attending the Supplementary call's assessment implies accepting the grade obtained at the Regular call. Nevertheless, CA students will keep the average grade obtained (0-1) from the short lab exercises.

LAB. END-OF-STUDIES CALL

It will consist of an exam similar to the FLE of the Regular call.

GENERAL REMARKS

All exercises and exams in this course are graded from 0 to 10. **As a consequence of short exercises, the student's grade may be higher than 10. In that case, the final grade would be 10, considering the total grade higher than 10 for the awarding of honours.**

Not participating in the Supplementary call assessment process implies accepting the grade obtained at the Regular call assessment.

TUTORING

Tutoring sessions will be suspended t**wo school days prior** to any official exam.

CONTINUOUS ASSESSMENT ELIGIBILITY

Students may opt for CA independently for the classroom/theory part and lab/practical part. To be eligible for CA, students must take the first exam in that part (theory/ET1 and/or lab/EP1).

Once being enrolled in CA for theory or lab, students cannot opt for GA for the corresponding part. As pointed out above, students may opt to be assessed differently (CA or GA) for theory and lab.

OFFICIAL TRANSCRIPTS

If a student is graded at least once after taking any of the exams in CA or GA, its final grade will be computed according to this guide.

EXAMS

To take any classroom exam (ET1, ET2, FE) or lab exam (EP1, EP2, FLE), all students must register using the designated software tool. The registration process will be open and notified with a minimum of 5 calendar days prior to the corresponding exam.

GRADING INFO

The date and procedure for grade review will be published in advance.

COMMUNICATION WITH STUDENTS

Communication between students and lecturers will be done by means of the standard procedures established by the University. **It is assumed that all students read their email (the one registered in Moovi) at least once a day.**

ETHICAL CODE

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution. All students are expected to have an ethical behavior in all exams, ensuring equal opportunities for all students. If an infraction is detected in an exam, the score obtained in that test will automatically be zero (0) and a report will be issued to the School Direction to take actions.

These are some examples of unethical behavior: use of electronic devices (mobile phones, tablets, computers, etc.), copy from another peer, use of unauthorized material in an exam, etc.

Sources of information
Basic Bibliography
Gregorio Fernández Fernández, **Curso de Ordenadores. Conceptos básicos de arquitectura y sistemas operativos.**, 5ª, Fundación Rogelio Segovia para el Desarrollo de l, 2004
Silberschatz, H.F. Horth y S. Sudarshan, **Fundamentos de Bases de Datos.**, 6ª, McGraw-Hill Interamericana de España S.L., 2014
Complementary Bibliography
A. S. Tanenbaum, **Organización de Computadoras. Un enfoque estructurado.**, 4ª, Pearson Educación, 2000
J.L. Hennessy y D.A. Patterson, **Arquitectura de los Computadores. Un enfoque cuantitativo**, McGraw-Hill Interamericana de España S.L., 2010
Martín Llamas Nistal, Fernando A. Mikic Fonte y Manuel J. Fernández Iglesias, **Arquitectura de Ordenadores: Problemas y Cuestiones de Teoría**, 1ª, Andavira, 2012
Alberto Gil Solla, **Ejercicios resueltos sobre Fundamentos de los Ordenadores**, 1ª, Andavira, 2004
Alberto Gil Solla, **Problemas resueltos de programación en ensamblador**, 1ª, Andavira, 2004

Fernando A. Mikic Fonte y Martín Llamas Nistal, **Arquitectura de Ordenadores: Problemas de Programación en Ensamblador**, 1ª, Andavira, 2012

C. Costilla Rodríguez, **Introducción a las Bases de Datos Modernas**, Fundación Rogelio Segovia para el Desarrollo de la, 2996

V.C. Hamacher, Z.G. Vranesic, S.G. Zaky,, **Organización de Computadoras**, 2ª, McGraw-Hill Interamericana de España S.L., 1996

D. A. Patterson y J.L. Hennessy (Traducido por J.M. Sánchez), **Organización y diseño de Computadores. La interfaz hardware/software**, McGraw-Hill, 1995

Peter Knaggs, **ARM: Assembly Language Programming**, Peter J. Knaggs, 2016

Gregorio Fernández Fernández, **Elementos de Sistemas Operativos, de representación de la información y de procesadores hardware y software**, DIT-UPM, 2015

Sergio Barrachina Mir, Maribel Castillo Cata- lán, Germán Fabregat Llueca, Juan Carlos Fernández Fer, **Introducción a la arquitectura de computadores con QtARMSim y Arduino**, Universitat Jaume I, 2018

Sergio Barrachina Mir, Maribel Castillo Cata- lán, Germán Fabregat Llueca, Juan Carlos Fernández Fer, **Prácticas de inntroducción a la arquitectura de computadores con QtARMSim y Arduino**, Universitat Jaume I, 2014

Recommendations

IDENTIFYING DATA				
Programming II				
Subject	Programming II			
Code	V05G301V01110			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	English			
Department				
Coordinator	Blanco Fernández, Yolanda			
Lecturers	Blanco Fernández, Yolanda Fernández Masaguer, Francisco Gil Solla, Alberto			
E-mail	yolanda@det.uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The general objective of the course is to provide students with the theoretical foundations and practical skills that will allow them to analyze, design, implement and debug computer applications following the object-oriented paradigm. This is an eminently practical, student-centred course, where students have to complete several programming assignments. In order to facilitate the completion of the assignments, the course will first include a brief introduction to the discipline of Software Engineering, connecting it with the paradigm of Object Oriented Programming (OOP). The elements of OOP will then be analyzed in detail, with the help of UML elements and diagrams. English Friendly course: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English. In the completion of academic activities for this subject, the use of generative artificial intelligence (GAI) is permitted. Its use must be ethical, critical, and responsible. In the case of using GAI, any results it provides must be critically evaluated, and any generated citations or references must be carefully verified. Additionally, it is recommended to declare the use of the tools utilized.			

Training and Learning Results	
Code	
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
B14	CG14 The ability to use software tools to search for information or bibliographical resources.
C50	(CE50/T18)The ability to develop, interpret and debug programs using basic concepts of Object Oriented Programming (OOP): classes and objects, encapsulation, relations among classes and objects, and inheritance.
C51	(CE51/T19) The ability of basic application of phases of analysis, design, implementation and debugging of OOP programs.
C52	(CE52/T20) The ability of manipulation of CASE tools (editors, debuggers).
C53	(CE53/T21) The ability of developing programs considering to the basic principles of software engineering quality taking into account the main existing sources of norms, standards and specifications.

Expected results from this subject	Training and Learning Results	
To know the main UML diagrams for the documentation in the phases of analysis and design of programs according to the OOP.	B6 B14	C52 C53
To acquire maturity in techniques of development and debugging of programs to allow the autonomous learning of new skills and programming languages.	B6	C51 C52 C53
To understand the basic concepts of Object Oriented Programming (OOP).	B14	C50
To develop skills in the process of analysis, design, implementation and debugging of applications according to the OOP, taking into account the main standards and norms of quality.	B6 B14	C51 C53

Contents
Topic

1. Introduction to the object oriented paradigm	a. Brief introduction to the subject and its organization. b. Birth of the paradigm c. Foundations: classes and objects d. Concepts of encapsulation, inheritance (generalization), and polymorphism e. Brief introduction to UML
2. Encapsulation	a. Classes, interfaces and packages b. Methods and member variables. Visibility. Scope of resolution c. Constructor method d. Parameter passing: pointers and references e. Pointers to objects f. Use of UML class diagrams.
3. Inheritance	a. Derived classes and types of inheritance b. Abstract Classes c. Multiple Inheritance d. Object class
5. Polymorphism	a. Overloading and overwriting b. Abstract classes and interfaces c. Generic classes
6. Exception handling	a. Exceptions foundations b. Handling of Java exceptions
(*)Contidos prácticos.	(*)As prácticas propostas permitirán combinar a aplicación dos conceptos de POO explorados nas sesións teóricas co manexo de estructuras de datos e o desarrollo de lóxica algorítmica.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	30	55
Practices through ICT	10	17	27
Practices through ICT	10	21	31
Practices through ICT	13	19	32
Essay questions exam	1.5	0	1.5
Essay questions exam	1.5	0	1.5
Essay questions exam	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Classes involving explanation of OOP-related concepts and resolution of practical exercises. Through this methodology the competencies C50, C51 and C53 are developed.
Practices through ICT	Students will solve independently the assignments proposed. The solutions and doubts that arise when dealing with these assignments will be discussed in order to identify the most common mistakes made. Through this methodology the competencies C50, C51, C52, C53, B6 and B14 are developed.
Practices through ICT	Students will solve independently the assignments proposed. The solutions and doubts that arise when dealing with these assignments will be discussed in order to identify the most common mistakes made. Through this methodology the competencies C50, C51, C52, C53, B6 and B14 are developed.
Practices through ICT	Students will solve independently the assignments proposed. The solutions and doubts that arise when dealing with these assignments will be discussed in order to identify the most common mistakes made. Through this methodology the competencies C50, C51, C52, C53, B6 and B14 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Lecturers will solve the doubts raised by the students in relation to the concepts exposed in the lectures. Students may consult and request mentoring sessions through the Moovi platform (https://moovi.uvigo.gal).
Practices through ICT	Lecturers will supervise the level of understanding of the students, assisting them with doubts, design errors and improvements at the object-oriented code level. The Students may consult and request mentoring sessions through the Moovi platform (https://moovi.uvigo.gal).

Practices through ICT	Lecturers will supervise the level of understanding of the students, assisting them with doubts, design errors and improvements at the object-oriented code level. The Students may consult and request mentoring sessions through the Moovi platform (https://moovi.uvigo.gal).
Practices through ICT	Lecturers will supervise the level of understanding of the students, assisting them with doubts, design errors and improvements at the object-oriented code level. The Students may consult and request mentoring sessions through the Moovi platform (https://moovi.uvigo.gal).

Assessment

	Description	Qualification	Training and Learning Results
Practices through ICT	This is the first lab deliverable (hereinafter, E1). Students will be able to correct errors identified and retry the assessments, with a possible penalty, until a date to be determined (around mid-April). Once E1 assignments are graded, they will be uploaded to MOOVI, to check plagiarism.	10	B6 B14 C50 C51 C52 C53
Practices through ICT	This is the second lab deliverable (hereinafter, E2). Students will be able to correct errors identified and retry the assessments, with a possible penalty, until the latest date allowed by academic regulations and course organization requirements (actual date to be notified in due time). Once E2 assignments are graded, they will be uploaded to MOOVI, to check plagiarism.	20	B6 B14 C50 C51 C52 C53
Practices through ICT	Students will upload E3 assignments to MOOVI. E3 assignments will be graded by course lecturers outside lab sessions.	20	B6 B14 C50 C51 C52 C53
Essay questions exam	Each student will take, individually and without any kind of support material, an exam at the end of the term on the totality of the contents covered in the course. The maximum grade for this exam will be 3 points (out of 5) for students who sit continuous assessment, and 5 points for those students who choose the global assessment.	30	C50 C51 C53
Essay questions exam	Each student will take (individually and without any type of material of support) a test on the date the will be approved by CAG (approximately half of the academic period) on the contents that were explained up to one week before the exam. This test will be carried out only by students who sit continuous assessment, and the maximum grade will be 2 points (out of 5 points).	20	C50 C51 C53
Essay questions exam	This exam will be sit by students who opt for continuous evaluation and have submitted E3. In addition, the lab exam will be compulsory in the global evaluation of the ordinary call, in the extraordinary one and in the end-of-studies exam.	0	C50 C51 C53

Other comments on the Evaluation

There are two assessment mechanisms, continuous assessment (CA) and global assessment (GA), which must be chosen by the students considering the following conditions:

- Both the classroom and lab parts will be evaluated according to the same mechanism, CA or GA, as selected by the student.
- CA includes the exams described in the previous section: two theory exams, design and development of Java assignments collected in deliverables E1, E2 & E3, and a lab exam if E3 is submitted.
- Students will confirm the final evaluation modality (CA or GA) when submitting lab deliverables, depending on the submission date. The chosen evaluation modality will also be applied to the theory/classroom part. Therefore, in the case that a student finally chooses GA, the grade of the first classroom exam, if any, would be discarded.
- A minimum grade of 2 points (out of 5) in both theory/classroom and lab parts is required to pass the course.
- If the grade resulting from adding the classroom and lab grades is equal or higher than 5 points, but the student does not reach the minimum grade required in any of them, his/her final grade will be Fail (4.5).
- If a student attends any of the evaluation tests of the course, he/she will not be able to appear in transcripts as "no-show".
- The CA tests will only take place on the dates established by the teachers, and cannot be resit or delayed.
- Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be *Fail(0)*, and the incident will be reported to the corresponding academic authorities for prosecution.

Assessment procedure for the ordinary call for students who opt for Continuous Assessment (CA)

- **Theory/classroom part (50%)**: The grade of this part (5 points) is obtained by adding the corresponding grades of the two classroom exams (midterm and end-of-semester), with maximum grades of 2 and 3 points, respectively.
- Lab part (50%): The following considerations should be taken into account:
    - There will be deadlines to finish each assignment.
    - Some of the assignments will be reviewed in the laboratory once completed.
    - In addition to the correct functioning of the assignments, students must answer the teachers' questions to be able to continue in CA.
    - The grade for the practical part will depend on the qualifications obtained in the deliverables E1, E2, and E3 (up to 5 points in total).
    - Students who submit E3 must also take a practical exam: if they do not pass it (not approved), the grade for E3 will be 0 points.

Students who do not pass the subject in the ordinary opportunity can retain the grade obtained in both theory and practice for the extraordinary opportunity, provided the following conditions are met:

- The practice will be retained if at least 1.5 out of 5 is obtained in the theory.
- The theory will be retained if the practices were submitted and the minimum laboratory grade (2 points out of 5) was obtained.

Assessment procedure for the ordinary call for students who opt for Global Assessment (GA):

- **Classroom part (50%)**: The grade of this part (5 points) corresponds to an individual exam without any type of supporting material at the end of the academic semester (on the date approved by the school).
- **Lab part (50%)**: The grade for this part depends on the grades obtained in deliverables E1, E2 and E3 (up to 5 points in total) and the result of a practical exam. The deliverables may be identical to those required in CA or include modifications in the functionalities to be developed. They will be delivered through Moovi and will be evaluated by lecturers outside lab sessions. The student must pass a practical exam in which a modification of E2 or E3 will be required (depending on the specific deliverables submitted for assessment). In case of not passing it (i.e., Fail grade), the grade of the corresponding deliverable will be 0 points.

Assessment procedure for the extraordinary call and end-of-program call:

- **Classroom part (50%)**. Individual exam on the date to be approved by the school, requiring a minimum grade of 2 points (out of 5).
- **Lab part (50%)**. The corresponding E1, E2 and E3 deliverables must be uploaded to Moovi and a lab exam must be sit. Assignments may be the same CA/GA assignments or may include modifications in functionality and/or scoring. As there is no CA, assessment procedures are the same as as ordinary call's GA.

Sources of information

Basic Bibliography

Yolanda Blanco Fernández, **Introducción a Programación Orientada a Objetos**, 1ª edición, Andavira, 2019

W. Savitch, **Absolute Java**, 6ª edición, Pearson, 2015

Y. D. Liang, **Introduction to Java programming**, 8ª, Pearson, 2010

P. Deitel, H. Deitel, **Java: How to program**, 11, Pearson, 2017

Complementary Bibliography

B. Eckel, **Thinking in Java**, 4ª edición, Prentice-Hall, 2006

P. Niemeyer, D. Leuck, **Learning Java**, 4ª edición, O'Reilly., 2013

Oracle, **Java SE. Oracle**,

Oracle, **Java API Specifications**, 2022

G. Booch, J. Rumbaugh, I. Jacobson, **The Unified Modeling Language User Guide**, 2, Addison-Wesley., 2005

S. Zakhour, S. Hommel, J. Royal, I. Rabinovitch, T. Risser, M. Hoeber, **The Java Tutorial. A short course on the basics**, 6ª edición, Prentice-Hall, 2014

A. Eberhart, S. Fischer, **Java Tools**, Wiley, 2002

M. Page-Jones, **Fundamentals of object-oriented design in UML**, Addison-Wesley, 2002

M. Fowler, **UML Distilled: A Brief Guide to the Standard Object Modeling Language**, 3ª edicion, Addison-Wesley., 2003

Recommendations

Subjects that it is recommended to have taken before

Programming I/V05G301V01105