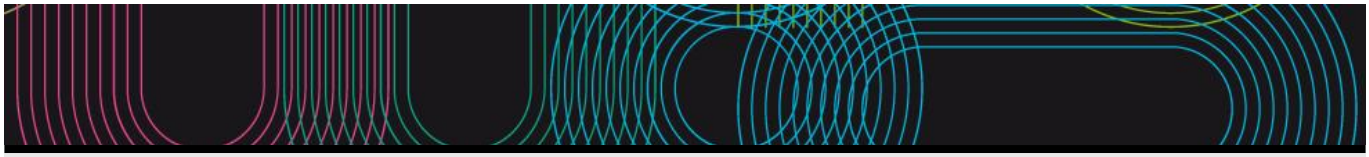

(*)Escola de Enxeñaría de Telecomunicación

(*)Páxina web

(*)

www.teleco.uvigo.es

(*)Presentación

(*)

A Escola Enxeñaría de Telecomunicación oferta para o curso académico 2017-18 un grao e dous másteres totalmente adaptados ao Espacio Europeo de Educación Superior, verificados pola ANECA axustándose á Orde Ministerial CIN/352/2009. A continuación indícanse os enlaces de acceso aos dípticos informativos dos tres títulos.

Grao en Enxeñaría de Tecnoloxías de Telecomunicación

http://teleco.uvigo.es/images/stories/documentos/gett/diptico-uvigo-eet-grao-gal.pdf

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

Máster en Enxeñaría de Telecomunicación

http://teleco.uvigo.es/images/stories/documentos/met/diptico-uvigo-eet-master-gal.pdf

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

Máster Interuniversitario en Matemática Industrial

http://teleco.uvigo.es/images/stories/documentos/promocion/M2i_Presentacion.pdf

www: http://m2i.es

(*)Equipo directivo

(*)

EQUIPO DIRECTIVO DEL CENTRO

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Subdirección de Extensión: Francisco Javier Díaz Otero (teleco.subdir.extension@uvigo.es)

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Secretaría e Subdirección de Infraestruturas: Miguel Ángel Domínguez Gómez (teleco.subdir.infraestructuras@uvigo.es)

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Coordinadora do Módulo de Telecomunicación: Yolanda Blanco Fernández (Yolanda.Blanco@det.uvigo.es)

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Coordinador do Módulo de Sistemas de Telecomunicación: Marcos Curty Alonso (mcurty@com.uvigo.es)

Coordinador do Módulo de Sone Imaxe: Manuel Sobreira Seoane (msobre@gts.uvigo.es)

Coordinador do Módulo de Telemática : Raúl Rodríguez Rubio (rrubio@det.uvigo.es)

Coordinadora do Módulo de Optatividad: Ana Vázquez Alejos (analejos@uvigo.es)

Coordinador de Proxectos: Manuel Caeiro Seoane (manuel.caeiro@det.uvigo.es)

Coordinador de Mobilidade: Enrique Costa Montenegro (teleco.subdir.internacional@uvigo.es)

Coordinador de Prácticas Externas: Jorge Marcos Acevedo (teleco.practicas@uvigo.es)

Coordinador do TFG : Manuel Fernández Veiga (teleco.subdir.academica@uvigo.es)

Coordinador do Plan de Acción Titorial: Artemio Mojón Ojea (teleco.pat@uvigo.es)

COORDINACIÓN DO MESTRADO EN ENXEÑARÍA DE TELECOMUNICACIÓN

Coordinadora Xeral: María José Moure Rodríguez (teleco.master@uvigo.es)

COORDINACIÓN DO MESTRADO INTERUNIVERSITARIO EN MATEMÁTICA INDUSTRIAL

Coordinador Xeral: José Durany Castrillo (durany@dma.uvigo.es)

Degree in Telecommunications Technologies Engineering

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V05G306V01101	Mathematics: Calculus 1	1st	6
V05G306V01102	Mathematics: Linear algebra	1st	6
V05G306V01103	Physics: Fundamentals of Mechanics and Thermodynamics	1st	6
V05G306V01104	Business: Company Fundamentals	1st	6
V05G306V01105	Programming I	1st	6
V05G306V01106	Mathematics: Calculus 2	2nd	6
V05G306V01107	Mathematics: Probability and Statistics	2nd	6
V05G306V01108	Physics: Analysis of Linear Circuits	2nd	6
V05G306V01109	Informatics: Computer Architecture	2nd	6
V05G306V01110	Programming II	2nd	6

IDENTIFYING DATA

Mathematics: Calculus 1

Subject	Mathematics: Calculus 1			
Code	V05G306V01101			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Calvo Ruibal, Natividad			
Lecturers	Calvo Ruibal, Natividad			
E-mail	nati@uvigo.es			
Web	http://faitic.uvigo.es			
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, he will learn to handle some computer programs of symbolic calculation and graphic representation.			

Competencies

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.

Learning outcomes

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. Scalar product, norm. Vector product. Functions of several variables. Limits. Continuity. Bolzano's theorem.
Topic 4. Coordinate systems for the plane and space.	Polar, cylindrical, and spherical coordinates.

Topic 5. Derivatives of functions of one variable and applications of the derivative.	Derivatives of a function in 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 6. Differential of functions of several variables.	Directional derivatives. Partial derivatives. Jacobian matrix. The chain rule. Higher order derivatives. Differential operators.
Topic 7. Applications of the differential calculation.	Extreme values. Extreme values with equality constraints. Newton's method.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	38	66.5	104.5
Problem solving	10	14	24
Laboratory practical	2	1.5	3.5
Problem and/or exercise solving	4	8	12
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 teacher will expose the theoretical contents of the matter. Through this methodology competencies CG3, CE1 and CT3 are developed.
Problem solving	The teacher 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 teacher will attend personally the doubts and queries of the students in the schedule of personal tutorials at the teacher's office or by email.
Problem solving	The teacher will attend personally the doubts and queries of the students in the schedule of personal tutorials at the teacher's office or by email.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	First session (1 hour): Topics 1 and 2.	10	B3 B4	C1
	Second session (1 hour): Topics 3 and 4.	12.5		
	Third session (1 hour): Topic 5.	10		
	Fourth session (1 hour): Topic 6.	17.5		
	The four previous sessions give 50% of the course mark. Individual assessment.	50		
Problem and/or exercise solving	Final exam on topics 4, 6, and 7 of the subject. Its grading will be 50% of the course mark. Individual assessment.	50	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

In order to opt for continuous assessment student should complete a registration form for this type of evaluation and deliver it to the corresponding teacher before the date in which the second session will take place. After then it will not be possible to change the option of evaluation. Continuous assessment consists of the previous four 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 = (1/10) x C + (5/10) x E

C: grading, between 0 and 50, obtained as the sum of the marks of the four one-hour sessions.

E: grading, between 0 and 10, obtained in the final exam on the topics 4, 6, and 7 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.

2. Exam-only 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, 6, and 7) which will not necessarily be the same as the one for the students who choosed continuous assessment. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

3. Second call

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= (1/10) x C + (5/10) x D

C: Mark, between 0 and 50, obtained as the sum of the gradings of the one-hour sessions.

D: Mark, between 0 and 10, obtained in an exam on the topics 4, 6, and 7 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, 6, and 7 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 he did not choose continuous 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,

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

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

Mathematics: Linear algebra/V05G301V01102

IDENTIFYING DATA				
Mathematics: Linear algebra				
Subject	Mathematics: Linear algebra			
Code	V05G306V01102			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Martín Méndez, Alberto Lucio			
Lecturers	Martín Méndez, Alberto Lucio Prieto Gómez, Cristina			
E-mail	amartin@dma.uvigo.es			
Web	http://faitic.uvigo.es/			
General description	The subject Linear Algebra is taught in the first quadmester 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. It will be paid special attention to the applications of Linear Algebra.			

Competencies	
Code	
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical topics.
A4	Students can communicate information, ideas, problems and solutions to both general and specialized public.
B1	CG1: The ability to write, develop and sign projects in the field of Telecommunication Engineering, according to the knowledge acquired as considered in section 5 of this Law, the conception and development or operation of networks, services and applications of Telecommunication and Electronics.
B2	CG2: The knowledge, comprehension and ability to apply the needed legislation during the development of the Technical Telecommunication Engineer profession and aptitude to manage compulsory specifications, procedures and laws.
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.
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
B7	CG7: The ability to analyze and assess the social and environmental impact of technical solutions.
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.
B11	CG11 To approach a new problem considering first the essential and then the secondary aspects
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
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.
C5	CE5/FB5: The necessary knowledge of business concepts, of law and institutional frameworks. business organization and management .
C7	CE7/T2: The ability to use communication and software applications (ofimatics, databases, advanced calculus, project management, visualization, etc.) to support the development and operation of Electronics and Telecommunication networks, services and applications.
C8	CE8/T3: The ability to use software tools for bibliographical resources search or information related with electronics and telecommunications.
C25	CE25/ST5 The ability to select transmission antennas, equipment and systems, propagation of guided and non-guided waves, with electromagnetic, radiofrequency and optical media, and their corresponding radio electric spectrum management and frequency designation.
C36	CE36/SI3 The capacity to implement projects at places and installations for the production and recording of audio and video signals.
D1	CT1 Development of sufficient autonomy to carry out works within the area of Telecommunications in interdisciplinary contexts.

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.
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.

Learning outcomes

Expected results from this subject		Training and Learning Results		
Skill development the basic operations of matrix algebra.		B1 B3 B4 B6 B7 B9 B11	C1 C7 C8 C25	D1 D2 D3
Knowledge of numerical methods for solving systems of linear equations and knowledge of the basic concepts involving vector spaces and linear maps.		B1 B3 B4 B6 B7 B9 B11	C7 C8 C25	D1 D3
Knowledge of the properties of vector spaces with inner product.		B1 B4 B6 B7 B9 B11	C1 C7 C8 C25	D1 D3
Skill development some applications of linear algebra: the method of least squares, singular value decomposition and classification of quadratic forms	A3 A4	B1 B2 B3	C1 C4 C5	D1 D3 D4
To know the arithmetic of complex numbers.	A3 A4	B2 B3 B4	C1 C36	D1 D2 D3 D4

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, determinants and systems of linear equations	Matrix operations: addition, scalar multiplication and product of matrices. Matrix inverse. LU decomposition. Block matrices. Determinants. Systems of linear equations. The matrix equation Ax=b. Solution set of a system of linear equations. The matrix of a system of linear equations. Elementary row operations and Gauss' method. Numerical methods for the systems of linear equations.
Topic 3. Vector Spaces and Linear transformations	Linear independence. Subspaces. Basis. Dimension. Rank of a system of vectors and rank of a matrix. Introduction to linear transformations. Matrix of a linear transformation. Composition of linear transformations and the product of matrices.
Topic 4. Matrix diagonalization.	Eigenvalues and eigenvectors. Eigenspace. Matrix diagonalization and diagonalizable matrices.
Topic 5. Orthogonallity.	Real Euclidean inner product. Complex Hermitian inner product. Orthogonallity. Gram-Schmidt. 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	38	76	114
Problem solving	9	9	18

Problem and/or exercise solving	5	5	10
Essay questions exam	2	2	4

*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. Individual. Through this methodology the competences CG3, CG4, CE1, CT2 and CT3 are developed.
Lecturing	Explanation and development by the teacher of the contents of the various topics in the syllabus. Individual. Through this methodology the competences CG3, CE1 and CT3 are developed.
Problem solving	Resolution by part of the professor of suitable exercises adapted to each topic. Individual. The students will also have to take part in the resolution of exercises in order to strengthen their knowledge. Through this methodology the competences CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized assistance

Methodologies	Description
Problem solving	Personalized tutoring will be available from all the teachers of the subject. They will be held in the respective offices of the teachers unless announced otherwise.
Laboratory practical	Personalized tutoring will be available from all the teachers of the subject. They will be held in the respective offices of the teachers unless announced otherwise.
Lecturing	Personalized tutoring will be available from all the teachers of the subject. They will be held in the respective offices of the teachers unless announced otherwise.
Tests	**Description**
Problem and/or exercise solving	Personalized attention will be available for assistance in the revision of tests and exams.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	Continuous evaluation consists in four short tests to be given in the class hour and also on exercises to be turned-in in class. The approximate planning will be the following: Four one hour tests: 1. Exam of topic 1. Individual assessment. 2. Exam of topic 2 and 3. Individual assessment. 3. Exam of topic 4. Individual assessment. 4. Exam of topic 5. Individual assessment. Each of these tests will have a weight of 10% in the final grade. Exercises to be turned-in in class have a weight of 10% in the final grade. The total weight of the continuous evaluation in the final grade will therefore be of 50%. 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.	50	B3 B4	C1
Essay questions exam	A written two-hour exam of topics 1, 2, 4, and 5 at the end of the semester in date, time and venue determined in the official exams calendar of the School. Individual assessment.	50	B3 B4	C1

Other comments on the Evaluation

First call:

Continuous assessment:

A student who chooses to be graded by continuous evaluation must do it in writing way in the manner and date indicated by the professors of the subject. In that case the final grade is calculated by the formula:

$$N = ((E1 + E2 + E3 + E4) + P + 5\ EF) / 10$$

where E1, E2, E3 y E4 are the points, in a scale 0 to 10, obtained in the four test of the continuous evaluation, P represents the total points, in a scale 0 to 10, obtained in the homework and where EF represents the points, in a scale 0 to 10, obtained in the final exam. A passing grade is N greater or equal to 5. 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.

Eventualassessment**:**

The students who do not choose to be graded by continuous evaluation, will be graded by means of a final exam (which will not be necessarily the same as the one for the students who choosed continuous evaluation) 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. Individual assessment.

Second call:

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 and 5. On the day of this second final, the students who were graded by continuous evaluation may choose to be graded exclusively by the second final or to be graded taking into account the points obtained in their continuous evaluation by the same formula used earlier, that is:

$$NR = ((E1 + E2 + E3 + E4) + P + 5\ EFR) / 10$$

where now EFR is the grade, in a scale 0 to 10, in the second final.

The students who choose to be graded exclusively by the second final will be graded with the result of the symmetric rounding to a decimal of the grade, between 0 and 10, obtained in the second final (which will not be necessarily the same as the one for the students who made the opposite choice). This second final will also cover the topics 1, 2, 3, 4 and 5. Individual assessment.

"No presentado":

A student will obtain a cualification of "No Presentado" in the first edition of the final grades if and only if that student did not choose the continuous evaluation and did not attend the final exam.

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

Extraordinary call:

The students which attend the Extraordinary call will write an exam covering topics 1, 2, 3, 4 and 5 which will be graded in a scale of 10 points and the passing grade cutoff will be 5. Individual assessment.

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.

Sources of information
Basic Bibliography
D. Poole, **Álgebra lineal: Una introducción moderna**, 2º,
L. Merino; E. Santos, **Álgebra lineal con métodos elementales**, 1ª,
J. de Burgos, **Álgebra lineal y geometría cartesiana**, 2ª,
Complementary Bibliography
D. C. Lay, **Álgebra lineal y sus aplicaciones**, 3ª,

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	V05G306V01103			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly English			
Department				
Coordinator	Chiussi , Stefano			
Lecturers	Chiussi , Stefano			
E-mail	schiussi@uvigo.es			
Web	http://faitic.uvigo.es			
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.			

Competencies

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.

Learning outcomes

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	15.5	46.5	62
Laboratory practical	9	13.5	22.5
Essay questions exam	1	0	1
Problem and/or exercise solving	1.25	0	1.25
Practices report	1.25	0	1.25

*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 CG3, CE3, CG5, CG6 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 CG3, CE3, CG5, CG6 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 CG3, CE3, CG5, CG6 and CT3 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 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 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 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.	30	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.	52	B3 B5 B6	C3
Practices report	Execution of real and simulated measurements. Real- and simulated-measurement result processing.	18	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.)

Following the particular guidelines of this degree, the students taking this subject will be offered two alternative assessment systems: continuous assessment and single assessment.

It will be assumed that a student chooses continuous assessment if he or she takes and hands the third assessment exercise in (see §1.1) and that he or she chooses single assessment if he or she does not hand the aforementioned exercise in. Once the results of this exercise are handed in, it will be understood that the student has taken the current term's examination call and he or she will be qualified in the first assessment chance of the regular call according to the criteria that are detailed in §2.1, regardless of whether he or she takes the End of Semester Examination or not.

Proper ethical behaviour is requested from the students. In the event that the lecturers in charge of the assessment notice unethical behaviour (cheating, plagiarism, introduction or use of means not permitted by the rules and instructions for the assessment exercises and tests, etc.), the student will be regarded as not meeting the necessary requirements to pass the

subject. In this case, the student will be assigned an overall grade of 0 (zero points) for the current academic year and the fact will be communicated to the head of the Centre to take appropriate measures.

1. ASSESSMENT TESTS

1.1. CONTINUOUS ASSESSMENT INTERMEDIATE EXERCISES

The schedule of the exercises will be approved in a "Comisión Académica de Grado" (CAG) and made available by the beginning of each semester. These exercises are not retakeable, i.e., they can be only taken in the scheduled dates. The examinations (§1.2) allow recovering part of the lost marks up to reach the maximum overall grade (see §2.1).

As a general rule, the marks of each exercise will be published before the next one. The marked exercises may be revised, during the tutorial-aid hours of the corresponding lecturer , along the fourteen days following the publication date of the marks.

The marks obtained in the exercises will be only valid for the two assessment chances of the regular call (see §2.1) of the academic term the exercises have been taken.

Three exercises will be scheduled:

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).

TC) Combined individual test with questions and exercises. Questions about theoretical concepts and solving of elementary cases and situations related to the topics in the classroom syllabus (mark TC between 0 and 1 point). Length: 30 minutes during one of the theory or problem-solving lectures.

The exercises not taken by the student will be marked with 0 (zero points).

1.2. EXAMINATIONS

Combined individual tests with:

Tx) Questions and exercises, (mark Tx between 0 and 5 points distributed among them).

Px) Solving of one or two problems, (mark Px between 0 and 3,4 points distributed between them).

Lx) Solving of a laboratory problem comprising the execution of real or simulated measurements and the processing of the results (mark Lx between 0 and 1,6 points).

The parts of the examination that the student does not hand in will be marked with 0 (zero points).

Length: 2 hours in each of the dates officially assigned for the subject in the examinations schedule of the Centre.

1.2.1. Regular examinations

- First assessment chance: End-of-Semester Examination x = F (marks TF, PF, LF)

- Second assessment chance: Resit Examination x = R (marks TR, PR, LR)

1.2.2. Special examination

- End-of-studies call: End-of-Studies Examination x = E (marks TE, PE, LE)

2. REGULAR ASSESSMENT CALL GRADING

2.1. CONTINUOUS ASSESSMENT option

2.1.1. Combined experimental laboratory mark (LLx)

For each of the assessment chances the combined experimental laboratory mark will be calculated as the sum of marks LC1 and LC2 from continuous assessment (§1.1) and mark Lx from the corresponding examination. If this sum results greater than 2 (two points) its value will be truncated to 2 (two points).

$LLx = \min \{LC1 + LC2 + Lx , 2\}$

2.1.2. Overall grade

For each of the assessment chances the overall grade will be calculated as the sum of the marks of:

Tx) The questions and exercises part of the corresponding examination (§1.2.1).

TC) The questions and exercises continuous assessment test (§1.1).

Px) The problem solving part of the corresponding examination (§1.2.1).

LLx) The corresponding combined experimental laboratory mark (§2.1.1).

If this sum results greater than 10 (ten points) its value will be truncated to 10 (ten points).

OVERALL_x = min {Tx + TC + Px + LLx , 10}

2.2. SINGLE ASSESSMENT option

For each of the assessment chances the overall grade will be calculated as the sum of the marks of the corresponding examination (§1.2.1).

OVERALL_x = Tx + Px + Lx

3. SPECIAL END-OF-STUDIES CALL GRADING

The overall grade will be calculated as the sum of the marks of the End-of-Studies Examination (§1.2.2).

OVERALL_E = TE + PE + LE

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 overall grade 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 grading scale is established on the understanding that the minimum overall grade necessary to pass the subject is 5,0 points.

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,

Profesorado presente y pasado de la asignatura., **Guiones de las prácticas de «Física Fundamentos de Mecánica y Termodinámica»**, 2018-2019, 2018

Present and past lecturers of this subject, **Laboratory Notes for "Physics: Fundamentals of Mechanics and Thermodynamics""**, 2018

Oficina Internacional de Pesas y Medidas (BIPM), **Sistema Internacional de Unidades SI**, (8 obsoleto), 9, Centro Español de Metrología, (2008), pendiente

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

Recommendations

Subjects that continue the syllabus

Fundamentals of Sound and Image/V05G300V01405
Power Electronics/V05G300V01625

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	V05G306V01104			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly English			
Department				
Coordinator	Fernández Arias, Mª Jesús González Vázquez, Beatriz			
Lecturers	Fernández Arias, Mª Jesús González Vázquez, Beatriz			
E-mail	jarias@uvigo.es bgonza@uvigo.es			
Web	http://faitic.uvigo.es			
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.			

Competencies	
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.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
To propose improvement solutions and to control the start-up.			D2
To establish guidelines on the metrics and indicators that will be used to allow the managers of the company the evaluation and monitoring of computer systems	B4 B8	C5	D2
To manage the requirements and products of the team to reduce the time of completion of projects, improve consistency and accuracy in the business environment.	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: FINANCIAL MANAGEMENT	2.1. Finance functions. 2.2. Investment decisions. 2.3. Sources of finance for a business.
UNIT 3: OPERATION MANAGEMENT (PART I). GENERAL FEATURES	3.1. Research, development and technological innovation. 3.2. Functions of Operations Management. 3.3. Classification of productive processes. 3.4. The economic programming of the production. 3.5. The productivity: indicators of productivity.

UNIT 4: OPERATION MANAGEMENT (PART II).	4.1. The costs of production. 4.2. Break-even point. 4.3. Make-or-Buy decisions. 4.4. Operational leverage. 4.5. Inventory control.
UNIT 5: MARKETING MANAGEMENT	5.1 The market. 5.2 The competition. 5.3 Marketing system. 5.4 Marketing-mix.
UNIT 6: MANAGEMENT AND ORGANIZATION	6.1. The management system. 6.2. Human Resources management.
	Practical classes 1: Typology and nature of the firm Practical classes 2: ICT´s environment Practical classes 3: Analysis of the economic and financial structure of the company I Practical classes 4: Analysis of the economic and financial structure of the company II Practical classes 5: Analysis of the economic and financial structure of the company III Practical classes 6: Analysis of the results of the company Practical classes 7: Investment Decisions I Practical classes 8: Investment Decisions II. Practical classes 9: Financing I Practical classes 10: Financing II Practical classes 11: Productivity Practical classes 12: Production costs Practical classes 13: Production Practical classes 14: Business plan

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	56	84
Computer practices	24	36	60
Case studies	2	2	4
Objective questions exam	1	0	1
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
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 competencies CG8, CE5, CT2 are worked on.
Computer practices	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 activities are focused on developing the CG4 and CE5 competences in a practical way.
Case studies	Methodology of qualitative analysis in which the student studies a specific case, deepening, exploring, and qualifying various contents of the subject. With this methodology, the competences CG8, CE5, CT2 are worked on.

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 opportunity to attend the personalized tutorials in the professor's office at the time established by professors for this purpose at the beginning of the course and which will be published on the web page of the subject. 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 "Tema" platform at Faitic.
Case studies	In the case study the teacher will attend and guide in the doubts that may arise to students about the case raised.

Computer practices	In the practical sessions the professor will attend and orient about the doubts that could arise to the students on the contents of the exercises or problems raised.

Assessment

	Description	Qualification	Training and Learning Results		
Objective questions exam	Tests that will be carried out throughout the course, both in theory classes and practices, distributed in a uniform and scheduled way so that they do not interfere in the rest of the subjects	40	B4 B8	C5	D2
Essay questions exam	Final test that may contain partially or totally the contents of the subject developed in theory and practical classes.	60	B4 B8	C5	D2

Other comments on the Evaluation

Following the guidelines established in the degree, two evaluation systems will be offered: continuous assessment (with two options) and one unique evaluation exam at the end of the semester. In any of the two evaluation systems, all the competences of the subject are evaluated.

1. Continuous assessment

The continuous assessment will consist of two intermediate tests developed throughout the course, and which will be completed with an exam at the end of the semester. The dates to take the two intermediate tests will be planned by the Academic Committee of Degree and will be available at the beginning of the semester. These tests do not release material, but each one of them will deal with the contents studied up to the time of the test, both in theory classes and practices, which is why the last test will be given a greater weight in the calculation of the qualification with respect to the previous one, so that the first test weighs 40%, and the second test 60%.

If the students have passed the last test, and obtained a weighted average with a grade of 5, they will be exempt from taking the exam at the end of the semester. The grade obtained by the student in this case will be the weighted average grade of the two tests.

Students who do not pass the subject through the two intermediate tests, will have to complete the continuous assessment by taking an exam at the end of the semester that will consist of a test that will represent 60% of the grade that will be added to the grade obtained in the continuous evaluation (40% of the weighted average of the intermediate tests).

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.

2. Students who do NO opt by Continuous evaluation

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 second opportunity

The students must choose, and communicate in writing (one week before the exam), that they wish to be evaluated again, in its entirety, up to the maximum possible grade or follow the continuous evaluation procedure stipulated in the subject, maintaining the grade obtained in the previous assignments .

By default, the students save the results of the tests carried out in this course.

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 extraordinary opportunity at the end of the academic year

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

Important notice

In the case of detection of copy in any of the tests, the final qualification will be Fail (0), and the fact will be communicated to the Governing Board of the Faculty.

Sources of information
Basic Bibliography
Pérez Gorostegui, E., **Curso de introducción a la economía de la empresa**, 2009
Madura, Jeff, **Introduction to Business**, 2010
Diez-Viel, I., Martin de Castro, G., Montoro Sanchez, M.A., **Introduction to Business Administration**, 2012
Complementary Bibliography
Barroso Castro, C. (Coord.), **Economía de la empresa**, 2012
Fernández Sánchez, E. y otros, **Iniciación a los negocios para ingenieros. Aspectos funcionales**, 2008
García Márquez, F., **Dirección y Gestión Empresarial**, 2013
Iborra Juan, M.; Dasi Coscollar, A.; Dolz Dolz, C.; Ferrer Ortega, C.,, **Fundamentos de dirección de empresas. Conceptos y habilidades directivas,**, 2014
Moyano Fuentes, J.; Bruque Cámara, S.; Maqueira Marín, J.M.; Fidalgo Bautista, F.A.; Martínez Jurado, **Administración de empresas: un enfoque teórico-práctico**, 2011

Recommendations

IDENTIFYING DATA				
Programming I				
Subject	Programming I			
Code	V05G306V01105			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	#EnglishFriendly English			
Department				
Coordinator	Rodríguez Hernández, Pedro Salvador			
Lecturers	Rodríguez Hernández, Pedro Salvador			
E-mail	pedro.rodriguez@uvigo.es			
Web	http://faitic.uvigo.es			
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.			

Competencies	
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.

Learning outcomes			
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 (d) The conditional operator (?:) 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. Pointers: (a) Pointer arithmetic (b) Arrays and pointers (c) Pointers to pointers
Lecture 5: Functions	1. Function declaration and definition 2. Functions with no parameters: C inter function communication: local, global and static variables 3. Functions with parameters by value 4. Functions with parameters by reference 5. Command line arguments
Lecture 6: 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 7: Structured type variables	1. Introduction: Structured data types 2. Structures: (a) Declaration (b) Operations (c) Pointers and structures (d) Structures as parameters 3. Creation of data types 4. Unions
Lecture 8: 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	22	22	44
Laboratory practical	12	6	18
Project based learning	10	30	40
Laboratory practice	5	11	16
Objective questions exam	4	20	24
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 will 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. Some of these activities will require the submission of a report in order to be evaluated. Through this methodology the competencies CG4, CE12 and CT2 are developed.
Project based learning	In the last part of the term, the student must complete a low complexity project, under the instructor supervision, which includes individual and in group activities. 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.
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.
Project based learning	The professors will provide individual attention to the students along the term, solving their doubts and questions about the project. Questions will be answered during the supervising 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.

Assessment

	Description	Qualification	Training and Learning Results		
Project based learning	The student will develop a project in the last weeks of the term, and will submit the C code implementing it The project will be assessed individually in the final laboratory test.	30	B4 B9	C6 C12	D2 D4
Laboratory practice	Every 4 weeks, the student will take a practical individual test in the laboratory. At the end of the term, the student will take a final practical test. All of them will consist in the development of a program in the computer. Those tests will assess the student's progress with the laboratory practices and with the project.	20	B4	C12	
Objective questions exam	Every 4 weeks, the student will take a theory exam that may consist of: - short answer questions - multiple choice questions This exam will assess individually the student's mastership of the concepts introduced in the master sessions. The final exam on the whole contents of the subject will contain this type of questions too.	35	B4	C12	
Problem and/or exercise solving	The final exam will have a part consisting of problem and/or exercise solving	15	B4	C12	

Other comments on the Evaluation

The **course planning in lectures** and the estimated time of the **most important assessment milestones** is detailed below (the dates provided for both the theory and the laboratory tests are tentative: 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).

- Week 1: Theory introduction + Lecture 1
- Week 2: Lecture 2 | Practice introduction + Practice 1
- Week 3: Lecture 3 | Practice 2
- Week 4: Lecture 3 + **Theory Test 1** (PT1) | **Laboratory Test 1** (PL1)
- Week 5: Lecture 4 | Practice 3
- Week 6: Lecture 4 | Practice 4
- Week 7: Lecture 5 | Practice 5

- Week 8: Lectures 5 and 6 + **Theory Test 2** (PT2) | **Laboratory Test 2** (PL2)
- Week 9: Lecture 7 | Practice 6
- Week 10: Lecture 8 | Project (2h)
- Week 11: Lecture 8 | Project (2h)
- Week 12: **Theory Test 3** (PT3) | Project (2h) + **Laboratory Test 3** (PL3)
- Week 13: Project (2h)
- Week 14: Project (2h)
- Before the final exams, project submission
- Finals: **Final Theory Test** (PTF) - **Final Laboratory Test** (PPF)

The Final Theory Test (PTF) is an exam that may consist of short answer questions and/or multiple choice questions and problems and/or exercises. It assesses the mastership of the contents introduced in the lectures.

The Final Practice Test (PPF) assesses the proper coding in C to deal with a medium level project. While the project development is a group activity, it is assessed individually. Indirectly, the PPF also assesses the mastership of the contents introduced in the lectures and the laboratory practices.

Following the guidelines of the degree, students are offered two evaluation modes: **continuous evaluation** and **eventual evaluation**.

The subscription to perform the second partial tests, Theory Test 2 (PT2) and / or Laboratory Test 2 (PL2) will be interpreted as the decision to opt for continuous evaluation. The non-enrollment in the second partial tests will be interpreted as the decision to opt for the eventual evaluation.

CONTINUOUS EVALUATION

The continuous evaluation will be considered as "passed" if the final grade (NFC) obtained by the student is at least 5. This final grade is the weighted geometric mean of the Theory Grade and the Practice grade, calculated as follows:

NFC = NTC^0.5 * NPC^0.5

where:

- NTC is the Theory Grade by Continuous Evaluation, calculated as the weighted arithmetic mean of all the theory tests, according to the following expression:

NTC = 0.1*PT1 + 0.1*PT2 + 0.2*PT3 + 0.6*PTF

- NPC is the Practice Grade by Continuous Evaluation, calculated as the weighted geometric mean of the laboratory grade and the project grade, according to the following expression:

NPC = NLC^0.4 * NPR^0.6

Where:

- NLC is the Laboratory Grade, calculated as the weighted arithmetic mean of the 3 laboratory tests, according to the following expression:

NLC = 0.25*PL1 + 0.25*PL2 + 0.5*PL3

- NPR is the Project Grade, and it coincides with the grade obtained in the Final Practice Test:

NPR = PPF

Note that the application of geometric mean implies that it is not possible to pass the subject if any of the notes (NTC, NLC or NPR) is zero.

None of the tests in the continuous evaluation mode is repeatable; that is, the instructor has no obligation to reschedule an evaluated activity missed by a student.

The date and procedures for the revision of the grades will be known before the evaluation tests. The students will have the chance of reviewing the grades preferably within two weeks after the evaluation.

EVENTUAL EVALUATION

In order to pass the course by the eventual evaluation mode, the final grade obtained by the student (NFU) must be at least 5.

This mode will consist of the same final tests as the continuous evaluation one (although with different weights), that is, an exam that may consist of short answer questions and/or multiple choice questions and problems and/or exercises (Final Theory Test, PTF) and a practice test that will evaluate the project (Final Practice Test, PPF). The final grade by eventual evaluation is the weighted geometric mean of the theory and practice grades, calculated as follows:

NFU = NTU^0.5 * NPU^0.5

Where:

- NTU is the Theory Grade by Eventual Evaluation, that is, the grade obtained in the Final Theory Test:

  NTU = PTF

- NPU is the Practice Note by Eventual Evaluation, that is, the grade obtained in the Final Practice Test:

  NPU = PPF

Both the continuous evaluation grade (NFC) and the eventual evaluation grade (NFU) will be computed to all students that take the final tests (theory and practice). The final grade will be the higher one.

A "No Present" grade will be granted:

- If the student opts for the continuous evaluation mode, when no test is taken after the first partial tests (PP1 and PL1)
- If the student opts for the eventual evaluation mode, when no final test (PTF and PPF) is taken.

SECOND CALL EVALUATION

University regulations allow students to take an additional test to pass the course (second call evaluation).

In order to pass the course using this second call evaluation, the final grade obtained by the student (NFS) must be at least 5.

This second call evaluation will consist of an exam that may consist of short answer questions and/or multiple choice questions and problems and/or exercises (Second Call Theory Test: PTS) and a practice test which will include the evaluation of the project (Second Call Practice Test: PPS). The final grade is the weigthed geometric mean between the theory and practice grades, calculated as follows:

NFS = NTS^0.5 * NPS^0.5

Where:

- NTS is the Theory Grade by second call Evaluation: if the student takes the Second Call Theory Test, NTS will be the grade obtained in that test:

  NTS = PTS

  Otherwise, NTS will be the theory grade obtained in his/her first chance evaluation.

- NPS is the Practice Grade by second call Evaluation: if the student takes the Second Call Practice Test, NPS will be the grade obtained in that test:

  NPS = PPS

  Otherwise, NPS will be the practice grade obtained in his/her first chance evaluation.

END OF DEGREE

University regulations allow students who have 3 or less subjects left to graduate to take an extra call for these subjects.

In order to pass the course using the end-of-degree evaluation system, the final grade obtained by the student (NFG) must be at least 5.

This end-of-degree evaluation will consist of an exam that may consist of short answer questions and/or multiple choice questions and problems and/or exercises (End-of-degree Theory Test: PTG) and a practice test which will include the evaluation of the project (End-of-degree Practice Test: PPG). The final grade is the weigthed geometric mean between the theory and practice grades, calculated as follows:

NFG = PTG^0.5 * PPG^0.5

All the partial and final grades will only be valid for the term the student is enrolled to, that is, in case the student repeates the subject, he or she will not retain any of the grades of the previous year.

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

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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

Learn C Programming, 2019,

Learn C Programming, 2019,

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

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

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

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

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

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	V05G306V01106			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Martínez Varela, Áurea María			
Lecturers	Martínez Varela, Áurea María			
E-mail	avarela@uvigo.es			
Web	http://faitic.uvigo.es/			
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. 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.			

Competencies	
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.

Learning outcomes			
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

Theme 1. Integral calculus in R.	The Riemann integral Integrable functions. The fundamental theorem of the integral calculus. The theorem of the mean value. The rule of Barrow. Calculus of primitives: integration by parts and change of variable. Improper integrals.
Theme 2. Numerical integration.	Interpolatory quadratures. Properties. Error of interpolation. Particular cases: Poncelet, tapezoidal and Simpson formulas. Formulas of composite quadrature.
Theme 3. Orthogonal functions and series of Fourier.	Orthogonal functions. Fourier series. Developments of Fourier series for even and odd functions. Convergence. The Fourier transform.
Theme 4. Introduction to ordinary differential equations.	Differential equations. Generalities Concept of solution. Differential equations of first order. Existence and uniqueness of solution. Autonomous equations. Separate variables. Homogeneous equations. Exact equations. Linear equations. Families of curves and orthogonal paths.
Theme 5. Ordinary differential equations of second order.	Differential equations of second order and of upper order. Homogeneous and non homogeneous linear differential equations. Linear differential equations with constant coefficients. Indeterminate coefficients. Variation of parameters. Cauchy-Euler equation.
Theme 6. The Laplace transform.	Definition of the Laplace transform. Properties. Application to the solution of differential equations.
Theme 7. The multiple integral in the sense of Riemann.	The double and triple integrals in elementary regions. Change in the order of integration. Theorems of change of variable. Applications.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	19	19	38
Laboratory practical	3	6	9
Lecturing	28	56	84
Problem and/or exercise solving	5	10	15
Laboratory practice	1	3	4

*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 CG3, CG4, CE1, CT2 e CT3 are developed.
Laboratory practical	In these practices, the computer tools MATLAB or MAXIMA 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 CG4, CE1, CT2 e CT3 are developed.
Lecturing	The professor will expose in this type of classes the theoretical contents of the matter. Through this methodology the competencies CG3, CE1, CT2 e CT3 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 Faitic 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 FAITIC.

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 Faitic 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 FAITIC.
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 Faitic 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 FAITIC.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	Three "one hour sessions". 1st session: Theme 1 and 3. 2nd session: Theme 4, 5 and 6. 3rd session: Theme 7. These three sessions account for 35% of the score with the following weights: First: 15% (1.5 points) Second: 10% (1 point) Third: 10% (1 point) Final exam: 60% (6 points) Individual assessment	95	B3 B4	C1
Laboratory practice	The students will do a practice of laboratory of the Theme 2 using MATLAB or MAXIMA. Its value will be of 5% (0,5 points) Individual assessment	5		C1

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 assist to 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 academicsemester

1. Continuous assessment.

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

N = C + E

C: Note obtained by adding the scores of the four sessions of the items 1, 2, 3, 4, 5, 6 and 7.
E: Note of the final examination of the items 4, 5, 6 and 7.

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

2. Final evaluation of the semester.

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 **theywill pass the subject when the obtained score is greater than or equal to 5**.

3. Second chance and final chance.

Previously to the exam students who chose continuous assessment may choose, if desired, for an exam of the items 4, 5, 6 and 7. The final grade is obtained as

NR = C + ER

C: Note obtained by adding the scores of the four sessions of the items 1, 2, 3, 4, 5, 6 and 7.
ER: Note the final recovery examination of the items 4, 5, 6 and 7.

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 he is not enrolled in the continuous assessment and he does not attend any of the examinations** of the subject. Otherwise he is considered presented.

5. Final chance.

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,
E. Marsden - A.J. Tromba, **Cálculo vectorial**, 5ª,
D.G. Zill - M.R. Cullen, **Ecuaciones diferenciales**, 3ª,

Complementary Bibliography

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

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	V05G306V01107			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	English			
Department				
Coordinator	Fernández Bernárdez, José Ramón Alonso Alonso, Ignacio			
Lecturers	Alonso Alonso, Ignacio Fernández Bernárdez, José Ramón			
E-mail	ignacio.alonso@uvigo.es jramon.fernandez@uvigo.es			
Web	http://faitic.uvigo.es			
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.			

Competencies	
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.

Learning outcomes			
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 RV. CDF and discrete RV. Transformation of continuous RV: 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. Two-dimensional transformations: fundamental theorem. Changes of dimension. Correlation and regression.
Estimation and limit theorems	Sample and population. Estimators. Estimation of mean and variance. Sequences of RV. 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	24	24	48
Problem solving	13.5	28	41.5
Computer practices	14	7	21
Problem and/or exercise solving	2	7	9
Objective questions exam	0.5	2	2.5
Essay questions exam	2	26	28

*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 in big group. The 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. The students will be required to work previously on these problems. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.
Computer practices	Each topic will be completed with one or several sessions of computer practices. For this, a software developed by the teachers and specific questionnaires for each topic will be used. The 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 chance to attend tutorial sessions at the teacher´s office. Teachers will establish timetables for this purpose at the beginning of the course. These timetables will be published on the subject website.
Problem solving	Students will have the chance to attend tutorial sessions at the teacher´s office. Teachers will establish timetables for this purpose at the beginning of the course. These timetables will be published on the subject website.
Computer practices	Students will have the chance to attend tutorial sessions at the teacher´s office. Teachers will establish timetables for this purpose at the beginning of the course. These timetables will be published on the subject website.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	Students must solve a problem individually, three occasions along the course	37.5	B3 B4	C1

Objective questions exam	Students must answer a multiple choice test individually.	12.5	B3 B4	C1
Essay questions exam	Individual final exam.	50	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 Final exam assessment.

Continuous assessment is based on several tasks. 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.

Students who choose Continuous assessment:

Several tasks are evaluated with a grade between 0 and 10. 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.

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

Task 1: Weight 12.5%. Two parts, both with the same weight:

Part 1: Individual resolution of a problem

Part 2: Correction of the problem solved from somebody else

Task 2: Individual resolution of a multiple choice test. Weight 12.5%

Task 3: Individual resolution of a problem. Weight 12.5%

Task 4: Individual resolution of a problem. Weight 12.5%

Last Task: Final exam. A reduced version of the exam to be carried out by the students who choose Final exam assessment. Weight 50%

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.

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

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

The final grade for students who choose Continuous assessment will be calculated as the mean between the final exam and the average of the previous tasks marks. To minimize the impact of a possible miss on a task, the average of these will be computed excluding the worst grade.

Students who choose Final exam assessment or End-of-program call:

In this cases students will carry out one only final exam. This exam will be graded between 0 and 10, and this value will be the final grade of the student.

Second call

At the Second call, available only for students who have not passed the subject previously, students have to choose between Continuous and Final exam assessment, regardless of the system they chose at the First call. The choice has to be made before the exam is carried out. 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.

Sources of information

Basic Bibliography

JR Fernández, I. Alonso y A. Mojón, **Apuntes de Probabilidad y Estadística**, 10 ed, 2020

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

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

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

Complementary Bibliography

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

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

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

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

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

Recommendations

Subjects that continue the syllabus

Data Communication/V05G300V01301

Computer Networks/V05G300V01403

Signal Transmission and Reception Techniques/V05G300V01404

Basics of bioengineering/V05G300V01915

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	V05G306V01108			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	English			
Department				
Coordinator	García-Tuñón Blanca, Inés			
Lecturers	García Mateo, Carmen García-Tuñón Blanca, Inés			
E-mail	inesgt@com.uvigo.es			
Web	http://www.faitic.uvigo.es			
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).			

Competencies	
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.

Learning outcomes			
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
To master the language and symbolism of the discipline	B3	C4	D3

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
Computer practices	22	22	44
Laboratory practical	3	3	6
Problem and/or exercise solving	3	9	12
Laboratory practice	1	3	4
Essay questions exam	2	8	10
*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.
Computer practices	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. At the end of 3 sesions, students will solve a evaluable task in a individual way. Through this methodology the competencies CG3, CG4 and CE4 are developed.

Laboratory practical	Two practical sessions will be carried out in the hardware lab, assembling and measuring circuits tasks will be covered. Out of the total of 4 hours, 1 hour will be dedicated to the evaluation of these sessions. 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 addres by the professors on tutoring hours.
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, professors address the needs and queries of the students related to laboratory practices.
Computer practices	Professors set the pace of the session and resolve any questions that arise during the realization of practice. Also on the schedule tutoring, professors address the needs and queries of the students related to practices in computer rooms.

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: 1.5, 3 and 3 points, respectively. To pass the subject by continuous evaluation, it is compulsory to attend all three tests and obtain at least 0.75 points in the ECA3 test. In 3 of the 11 sessions of Group B the resolution of an evaluable task (ECB1, ECB2, ECB3) with a maximum score of up to 0.5 points each will be considered, which means a total of 1.5 points. The schedule of the tests will be approved in the CAG and will be available at the beginning of the semester.	90	B3 C4 B4
Laboratory practice	This test (ECHW) is done during Group B hours in the hardware laboratory. The specific day will be approved by the academic board (CAG) and will be available at the beginning of the semester. It is a test related to assembly and measurement of circuits, and will have a maximum score of 1 point. In these exercises the ability to work in groups, the adjustment to the design specifications and the presentation of results will be evaluated. In order to pass the subject by continuous evaluation, attendance at the two lab sessions (hardware) and its corresponding one is mandatory.	10	B3 C4 D2 B4 D3
Essay questions exam	Additionally to the continuous evaluation system based on the results achieved on the aforementioned tests, the students will have the option of a final examination. This final exam can include test type and/or reasoning questions, problem solving and/or exercises, as well as the development of practical cases. The maximum mark achieved on this exam will be 10 points.	0	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. First call.

The student is free to choose the continuous assessment above described, without excluding the possibility to do a final exam. Possible cases:

- Students only doing the continuous assessment (see point 5 in *Additional comments* section): they are graded with the points obtained in the continuous assessment.
- Students doing both the continuous assessment and the exam: they are graded with the best of both qualifications.
- Students only doing the final exam: they are graded with the points obtained in the exam.

2. Second call.

Students that do not reach the minimum grade at the end of the semester will have the option to do a final extraordinary exam of the full content of the subject, theory and practice. The extraordinary exam can include test type and/or reasoning questions, problem solving and/or exercises, as well as the development of practical cases. The maximum mark achieved on this exam (between 0 and 10) will be the final grade. It will replace the grade obtained during continuous evaluation (sum of the grades obtained during tests and final exam).

Additional comments:

- Students must attend to the group B assigned at the beginning of the semester.
- Group B attendance control will be carried out.
- The marks in all the evaluation tests are individual.
- HW sessions attendance will be mandatory.
- To pass the subject by continuous evaluation, it is compulsory to attend all three tests and obtain at least 0.75 points in the ECA3 test. In other case the continuous assessment mark will be calculated by:

$$\text{mark\_final\_CA} = \text{ECA3} + 4{,}25 \cdot \text{mark\_CA\_withoutECA3} / 6{,}5$$

- Doing ECA2 or sucessives tests and/or the final exams will prevent the student to get the "Not presented" mark.
- The average grade obtained during continuous evaluation will only be valid only for the corresponding academic year.
- It will be considered that the subject has been passed if the final grade is equal or above 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.

Sources of information

Basic Bibliography

James W. Nilsson, **Electric Circuits**, 10,

Material docente, **Página web**, faitic.uvigo.es,

Complementary Bibliography

J.H. McClellan, R.W. Schafer, M.A. Yoder, **Signal Processing First**,

Recommendations

Subjects that continue the syllabus

Physics: Fundamentals of Electronics/V05G300V01305
Digital Signal Processing/V05G300V01304
Signal Transmission and Reception Techniques/V05G300V01404
Microwave Circuits/V05G300V01611
Radio Frequency Circuits/V05G300V01511
Analogue Electronics/V05G300V01624
Engineering of Electronic Equipment/V05G300V01523

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	V05G306V01109			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	English			
Department				
Coordinator	Llamas Nistal, Martín Fernández Iglesias, Manuel José			
Lecturers	Fernández Iglesias, Manuel José Llamas Nistal, Martín			
E-mail	manolo@uvigo.es martin@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Computers have become an essential tool. This fact is even more clear while studying the "Bachelor of Engineering in Telecommunications Technology" (Grado en Ingeniería de Tecnologías de Telecomunicación), where computers are not only manipulated from a user's --or specialized user's-- point of view, but also from the engineering perspective, as tools to be designed or to be integrated in more complex systems. Hence, the main motivation for the "Computer Architecture" (Arquitectura de Ordenadores) course is to provide students with an understanding of basic computer operation by studying the lower abstraction levels (over the electronic level). The subject "Computer Architecture" (Arquitectura de Ordenadores) is focused on the conventional machine level, describes the operating machine level and shows an example application for the Symbolic Machine domain through the introduction of the Database Management Systems.			

Competencies	
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.

Learning outcomes			
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, memries, registries, buses. External Communication, active waiting, Introduction to addressing modes
3. Symbolic Representation and Processing .	Representation of basic data elements: integer, character, floating point. Conventions for data storage. Processing operations. Introduction to simbolic processing. Assembler language
4. Instructions and addressing	Instructions and addressing Software considerations. Registries at the conventional machine level. Lenguage for register transfer (RT level). Instruction format. Addressing modes. Stacks and subprograms. RISC and CISC computers.
5. RISC Computer	Formats and set of instructions. Addressing modes. Assembler. Example of programs.
6. CISC Computer	Formats and set of instructions. Addressing modes. Assembler. Example of programs
7. Periphery Management.	Types of peripherals. Management of variety. Models. Secondary memories. Interruptions. Service Rutines. ADM: justification
8. Parallelism and parallel Architectures	Ppipelining. Parallelism in the accesses to memory. Associative Memory. Parallel architectures. Vectorial processors. Multiprocessors.
9. Operating systems	Operative machine. Introduction to the Operating systems. Definition of an Operating system. Interface of an Operating system.
10. Databases	Introduction to the Databases. Relational model. Model Entity Relation. Languages of query. Introduction to SQL.

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	4	8	12
Problem and/or exercise solving	3	9	12
*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 practices that will performed using a simple computer (SIMPLEZ) and a regular computer. Through this methodology the competencies CG3, CG4, CT2, CT3 and CE2 are developed.
Introductory activities	Presentation of the course contents, methodology, office hours, evaluation, usage of the labs, and any other issue related to the subject. Through this methodology the competences CG3 and CT3 are developed.
Problem solving	Programming, information representation, and other problems and exercises will be solved during the classes. Some must be solved by students previously at home, and they will participate actively in the solution of some other problems. Through this methodology the 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 establish timetables for this purpose at the beginning of the course. This schedule will be published on the subject website.

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

Assessment

	Description	Qualification	Training and Learning Results		
Self-assessment	Exam questions will be available for students, in order to perform autoevaluation.	0	B3 B4	C2	
Laboratory practice	They will realise three practical exercises in the laboratory of continuous evaluation.	50	B3 B4	C2	D2 D3
Problem and/or exercise solving	They will realise in theory roughly 6 exercises of continuous evaluation, divided in two parts.	50	B3 B4	C2	D2 D3

Other comments on the Evaluation

ASSESSMENT

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

We consider:

-the Harmonic Average of A and B as HA(A,B)=2*A*B/(A+B). If A=B=0 then HA(A,B)=0

-the Arithmetic Average of A and B as AA(A,B)=(A+B)/2

We use the Mixed Average MA(A,B) in order to obtain grade in two different parts (A and B):

If A >= 5 and B >=5 then MA (A,B) =AA(A, B)

else {

if HA(A,B) > 3 then MA(A,B) = HA(A,B)

else MA(A,B) = AA(A,B), max. 3 (i.e. if AA(A,B)>3 then MA(A,B)=3)

}

In words, MA(A,B) is the arithmetic average if A and B are greater or equal to 5. Otherwise, MA(A,B) is the harmonic average. Besides, if the harmonic average is less than 3 then we apply the arithmetic average with a maximum possible score of 3.

The final grade for the course (FG) is as follows, according to theory grade (TG) and Practice Grade (PG): FG = MA(TG, PG). The assessment is individual.

To pass the course, FG must be greater than or equal than 5.

Both parts can be evaluated by Continuous Assessment (CA) or by Eventual Assessment (EA).

The EA will consist of Theory and Practice, and will take place in date and time officially established.

CA will consist of the tasks described in this guide, and they are not recoverable, i.e., if a student cannot follow them during the stipulated period the teacher does not have the obligation of repeating them.

If one of the parts (Theory or Practice) is passed in the First Call, the note is kept for the Second Call in which the student will only have to examine of the other part.

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

THEORY

The Theory part is divided into two sub-parts: T1 and T2. T1 covers up to theme 5 (included), while T2 the 100% of the syllabus.

The Theory uses the Blended Flipped Classroom (BFC) method. In a week, one hour class takes place outside the classroom watching videos, and the other hour in the classroom answering questions, solving exercises and assessing (if it is the case).

* FIRST CALL EXAMS

. CONTINUOUS ASSESSMENT (CA).

In CA, the student needs to do short exercises (around 10 or 20 minutes) during the weekly class time. The grade in T1 and T2 is calculated using arithmetic average of the exercises proposed for each part (approximately 3). All of these exercises will take place in the classroom and never during the exam period. If a student does not attend to some of these exercises, they will not be repeated.

Usually every two weeks a short exercise will be done.

The theory CA grade at First Call is TG=MA(T1,T2).

If a student does not pass the theory, but passes one of the two parts (T1 or T2), he/she keeps the grade of the part passed for the Second Call Exams. If he/she does not pass the two parts, he/she will have to go to the Eventual Assessment at Second Call.

. EVENTUAL ASSESSMENT

All student that have not followed the CA will have to go to the Eventual Assessment (EA). The EA consists of two exercises T1 and T2 (one of each of the parts), to be done in 90 minutes, and a test exam (TEST) to be done in 20 minutes.

The final score is: TG=0,8*MA(T1, T2) + 0,2*TEST

* SECOND CALL EXAM

The Second Call Exam has the same structure that the First Call one.

Not performing the evaluation in Second Call implies accepting the grade obtained in the evaluation in First Call.

If CA was not followed, and teoric part was not passed, the student will have to do T1, T2 and TEST exercises, regardless of the grades in each exercise in First Call Exam.

If the student did not pass the CA but passed T1 or T2, he/she can attend to the exam of the failed part. In this way, the grade obtained in CA is deleted, keeping the grade in the passed part. The calculation grade in theory is similar to the CA: TG=MA(T1,T2). In other case (both T1 and T2 failed), the student will have to do the Eventual Assessment (T1, T2 and TEST).

* EXTRAORDINARY CALL

It will consist of a exam similar to the one for the Eventual Assessment in the First Call.

PRACTICE

* FIRST CALL

. CONTINUOUS ASSESSMENT (CA)

The CA of Practice consists of 3 exercises P1, P2 and P3. P1 will be about Simple Computer, P2 about Basic Computer (around 60% of the syllabus) and P3 about Complete Computer (100% of the syllabus). The exercises will be done in the laboratory and will last approximately 1 hour. P1 will be around the 4th week, P2 around the 8th and P3 at the final exam day (the exam will be different for those who follow CA than for those who decide to go by EA). P1 and P2 will be held in afternoon shifts. 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.

The Practice CA grade is the weighted average of these exercises: PG=0,20*P1+0,35*P2+0,45*P3

. EVENTUAL ASSESSMENT

All the students that have not followed the CA will have to present to the Eventual Assessment (EA).

The EA of Practice will consist in an exercise on the Complete Computer to be done in the laboratory in 1h (approximately).

In this case, the Practice Grade is the grade of the Eventual Assessment.

* SECOND CALL EXAM

The student will have a Second Call Exam similar to the Eventual Assessment Exam of the First Call. All the students who did not pass the practical part, having followed the CA or not, will have to go to this exam.

*EXTRAORDINARY CALL

It will consist of a exam similar to the Eventual Assessment in First Call.

GENERAL QUESTIONS

All exercises and exams of the subject are scaled from 0 to 10. The TEST Exam of Theory can be negative.

ELECTION OF CONTINUOUS ASSESSMENT:

If a student does any of the exercises of CA (Theory or Practice), then it is considered that this part is being followed by CA, not being able to go to the Eventual Assessment of First Call of this part. Note that a student can follow, if he/she wants, a part (Theory or Practice) by CA, and the another part (Practice or Theory) by Eventual Assessment.

ACTS: Students who have attended any of the CA exercises (both practice and theory) will be considered as presented and their grade will be obtained by applying the corresponding formulas.

EXAMS: To take any theory exam (T1, T2 and Eventual Assessment) or practice (P1, P2, P3 and Eventual Assessment), in first, second or extraordinary calls, all students must register through the corresponding software tool, which will be notified with a minimum of 5 calendar days.

Note: Prior to an exercise or an exam, the date and procedure for the grade review will be published sufficiently in advance.

COMMUNICATIONS WITH STUDENTS: All communications of the teaching organization will be done through the informatics tools used in the course (FAITIC, BeA and e-mail). It is understood that all students read their e-mail (e-mail registered in FAITIC) 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,
Silberschatz, H.F. Horth y S. Sudarshan, **Fundamentos de Bases de Datos.**, 2ª,
Complementary Bibliography
A. S. Tanenbaum, **Organización de Computadoras. Un enfoque estructurado.**, 4ª,
J.L. Hennessy y D.A. Patterson, **Arquitectura de los Computadores. Un enfoque cuantitativo**,
Martín Llamas Nistal, Fernando A. Mikic Fonte y Manuel J. Fernández Iglesias, **Arquitectura de Ordenadores: Problemas y Cuestiones de Teoría**, 1ª,
Alberto Gil Solla, **Ejercicios resueltos sobre Fundamentos de los Ordenadores**, 1ª,
Alberto Gil Solla, **Problemas resueltos de programación en ensamblador**, 1ª,

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

C. Costilla Rodríguez, **Introducción a las Bases de Datos Modernas**,

V.C. Hamacher, Z.G. Vranesic, S.G. Zaky,, **Organización de Computadoras**, 2ª,

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

Stephen Welsh and Peter Knaggs, **ARM: Assembly Language Programming**, 2003

Gregorio Fernández Fernández, **Elementos de Sistemas Operativos, de representación de la información y de procesadores hardware y software**, 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**,

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**,

Recommendations

IDENTIFYING DATA				
Programming II				
Subject	Programming II			
Code	V05G306V01110			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	#EnglishFriendly English			
Department				
Coordinator	Fernández Iglesias, Manuel José Blanco Fernández, Yolanda			
Lecturers	Blanco Fernández, Yolanda Costa Montenegro, Enrique Fernández Iglesias, Manuel José			
E-mail	yolanda@det.uvigo.es manolo@uvigo.es			
Web	http://www.faitic.es			
General description	The general aim of this subject is to provide the students with the theoretical foundations and practical competitions to analyse, design, develop and debug computer applications following the Object-Oriented Programming (OOP) paradigm. Programming II is a mainly practical subject where students have to design and develop several programming projects. With the goal of supporting the students during the development of these software projects, firstly a very brief introduction to the discipline of Software Engineering and its relationship with the OOP paradigm will be given, putting the focus on the stages of analysis, design, implementation and debugging. Next, we will analyse in detail the foundations of OOP, highlight the advantages of UML diagrams for the design tasks that the students will have to carry out. 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.			

Competencies	
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.

Learning outcomes		
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 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
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

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
4. Object oriented design	a. Design foundations b. Use of UML 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

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	35	60
Laboratory practical	8	18	26
Case studies	3	6	9
Computer practices	16	35	51
Problem and/or exercise solving	1	0	1
Problem and/or exercise solving	2	0	2
Problem and/or exercise solving	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	Classes involving explanation of OOP-related concepts and resolution of practical exercises. These exercises can be solved by the professor or by the student, individually or in group. The aim is to encourage debates and strengthen the adquisition of competencies. Through this methodology the competencies CE50, CE51 and CE53 are developed.
Laboratory practical	The students will resolve the practices proposed by the professor. Solutions and doubts will be guided by the professor in order to identify common errors. Through this methodology the competencies CE50, CE51, CE53, CG6 and CG14 are developed.
Case studies	The professor will supervise and guide students during the design of UML diagrams, with the goal of identifying common errors. Through this methodology the competencies CE51 and CE52.
Computer practices	Students will develop the software system proposed by the professor during the second part of the academic period, by combining work in the classroom (supervised by the professor) and work outside the classroom. Through this methodology the competencies CE50, CD53, CG6 and CG14.

Personalized assistance

Methodologies	Description
Lecturing	The professor will help students by answering their doubts about the concepts explained in masterclasses.
Laboratory practical	The professor keeps track the level of understanding of the students, supporting them in particular doubts, design errors and possible improvements in their Java coding solutions.
Computer practices	Reviewing and comments throughout the development phase, helping students in compilation and understanding of execution-related problems, besides the detection and solution of conceptual errors.
Case studies	Analysis, detection of errors and discussion about possible improvements for students-proposed UML designs.

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	The students who sit CA will carry out a set of 4 Java practices (in groups of 2 people), which have been specifically thought for beginners with object-oriented programming. The maximum grade will be 1 point (out of 5 points). The grade assigned to each group will depend on the quality and right operation of the Java code submitted.	10	C50 C51 C52 C53
Case studies	The students will design the software project by the modeling language UML, including class diagrams and corresponding documentation to guide the decisions taken. Such preliminar UML design will be developed in groups of 2 students, and considered only in CA. The maximum grade will be 0.5 points (out of 5 points), and will be assigned depending on the quality and rigor of the delivered UML designs.	5	C50 C52
Computer practices	The project consists of the final design (UML class diagrams), Java coding and corresponding Javadoc documentation. The code must necessarily be compiled and run on the computers of the laboratory. It will be carried out individually (for CA) or in groups of 2 students (for EA). In order for the project developed by the student to be assessed, a computer exam must be passed. The final grade (between 0 and 3.5 points out of 5 points for CA, and between 0 and 5 points for EA) will be assigned as follows: 3 points (Java implementation) + 0.5 points (UML design) in CA, and 4 points (implementation) + 1 point (design) in EA.	35	B6 B14 C50 C53
Problem and/or exercise solving	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 CA, and the maximum grade will be 2 points (out of 5 points).	20	C50 C51 C53
Problem and/or exercise solving	Each student will take (individually and without any type of material of support) an exam on the official date to be approved by CAG, which will be about all the contents that were explained during the academic period. The maximum grade will be 3 points (out of 5) for CA students and 5 points for EA students.	30	C50 C51 C53
Problem and/or exercise solving	Each student will carry out an exam in computer laboratory, where a minor modification on the delivered Java project will be requested. The grade will be PASS or FAIL. Only the projects delivered by students who be able to pass the computer exam will be assessed (the grade of the rest of students will be 0 points).	0	C50 C51 C53

Other comments on the Evaluation

There exist two assessment mechanisms in this subject: continuous assessment (CA) and exam-only assessment (EA). The students must choose one of them considering the following conditions:

- CA consists of the tests described in the Assessment section of this document (2 theoretical exams, Java practices for beginners, UML design, Java implementatation of the project, and exam in computer laboratory).
- By the submission of the UML design of the project, students make a commitment to be assessed via CA, thus renouncing the EA mechanism. In virtue of this commitment, the final mark of these students cannot be *Not taken*.
- Students who do not deliver the UML design in time renounce CA mechanism, thus being assessed as per the requirements of EA. Note that it will be not possible to join the CA in the next tests.
- Students who sit EA must develop the software project (whose specifications will be published at faiTIC platform) individually. The rest of students will be organized in groups of 2 people.
- 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.
- CA tests will be carried out only on the dates defined by the professors. These CA tests cannot be repeated later.
- The grades obtained in the CA and other exams and practical projects are only valid for the current academic year.
- 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.

Students who sit CA in the first call will be assessed as follows:

Theoretical part: The grade of this part (5 points) is obtained by adding the corresponding marks to the two theoretical exams (halfway and end of academic semester), with maximum marks of be 2 and 3 points, respectively. A minimum grade of 2 points (out of 5) is required. Students who get this minimum mark in first-call can keep it for the second-call.

Practical part. The grade of this part (5 points) results from considering the marks of Java practices for beginners (1 point), initial UML design (0.5 points), exam in computer laboratory (PASS/FAIL), and Java project (3.5 points, where software development and final UML design will be assessed with 3 and 0.5 points, respectively). Passing the computer exam and a minimum grade of 1.5 points (out of the 3 points referred to the project implementation) are required. Students who fail in first-call and fulfill both conditions can keep the grade of the practical part for the second-call.

The students must fulfill the following requirements to pass the subject via the CA mechanism:

- To get at least 2 points in the theoretical part.
- To pass exam in computer laboratory and to get at least 1.5 points, out of the 3 points corresponding to the Java implementation of the project.
- To get a final grade (theoretical part + practical part) equal or greater than 5.
- If the final grade is equal or greater than 5 but some of the part does not fulfill the aforementioned minimum, then the final grade will be 4.5 (out of 10 points).

Students who sit EA in the first call will be assessed as follows:

Theoretical part: 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 to be approved by CAG). A minimum grade of 2 points is required. Students who get this minimum mark in first-call can keep it for the second-call.

Practical part. The grade of this part (5 points) results from considering the result of the exam in computer laboratory (PASS/FAIL) and the delivery of the software project, where the Java coding (4 points) and UML design (1 point) must be included. Passing the computer exam and a minimum grade of 2 points (out of the 4 points referred to the project implementation) is required. Students who fail in first-call and fulfill both conditions can keep the grade of the practical part for the second-call.

The students must fulfill the following requirements to pass the subject via the CA mechanism:

- To get at least 2 points in the theoretical part.
- To pass exam in computer laboratory and to get at least 2 points, out of the 4 points corresponding to the Java implementation of the project.
- To get a final grade (theoretical part + practical part) equal or greater than 5.
- If the final grade is equal or greater than 5 but some of the part does not fulfill the aforementioned minimums, then the final grade will be 4.5 (out of 10 points).

Students will be assessed as follows in both second call and end-of-program call:

The student will be assessed by the mechanism described for EA.

Theoretical part (50%). Individual exam on the date to be approved by CAG. Minimum grade: 2 points (out of 5).

Practical part (50%). Computer exam (PASS/FAIL) and Java project (5 points). The computer exam must be passed in order for the Java project can be assessed. Minimum grade: 2 points, out of the 4 points corresponding to the Java coding of the project.

Students who failed the subject on a previous call of the academic year can either keep their initial grades (if they are higher than the minimum mark required in the corresponding part) or ask to be re-assessed (in this case, the final grade will be the one obtained on the new call).

Sources of information
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Recommendations

Subjects that it is recommended to have taken before

Programming I/V05G301V01105