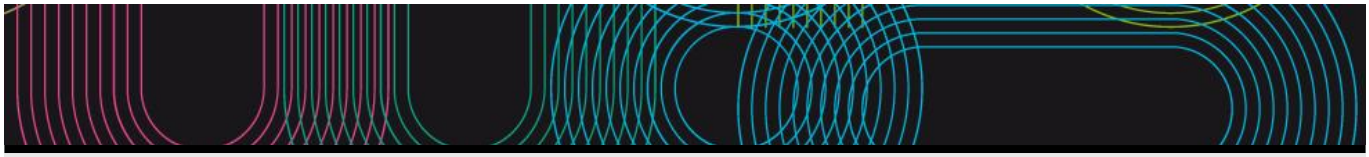

(*)Escola de Enxeñaría de Telecomunicación

(*)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

(*)

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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.
V05G300V01101	Business: Company Fundamentals	1st	6
V05G300V01102	Physics: Fundamentals of Mechanics and Thermodynamics	1st	6
V05G300V01103	Informatics: Computer Architecture	1st	6
V05G300V01104	Mathematics: Linear algebra	1st	6
V05G300V01105	Mathematics: Calculus 1	1st	6
V05G300V01201	Physics: Analysis of Linear Circuits	2nd	6
V05G300V01202	Physics: Fields and Waves	2nd	6
V05G300V01203	Mathematics: Calculus 2	2nd	6
V05G300V01204	Mathematics: Probability and Statistics	2nd	6
V05G300V01205	Programming I	2nd	6

IDENTIFYING DATA				
Business: Company Fundamentals				
Subject	Business: Company Fundamentals			
Code	V05G300V01101			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Mandado Vazquez, Alfonso			
Lecturers	Gil Pereiras, María del Carmen González-Portela Garrido, Alicia Trinidad Mandado Vazquez, Alfonso Pérez Pereira, Santos Rodríguez de la Fuente, Marta Suárez Porto, Vanessa María			
E-mail	amandado@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This subject has like objective give to know the organisation, management and institutional frame of the company.			

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
Manage the requirements and the products of team to reduce the time of realisation of the projects, and improve the coherence and the precision in the business surroundings.	B8 C5
Propose the solutions of improvement and control the set up.	B4 D2
Establish the guidelines on the metric and indicators that will be used to allow to the Direction of the company the evaluation and the follow-up of the computer systems	B4 D2

Contents	
Topic	
SUBJECT 0: INTRODUCTION	0.1 Glossary of financial terms.
Subject 1: THE *ECONOMIA OF THE COMPANY	1.1 The concept of company. 1.2 The aims of the company. 1.3 The company like system. 1.4 Forms and classes of companies. 1.5 Company and surroundings. 1.6 Surroundings Technologies of Information and Communication.
Subject 2: THE FINANCIAL SYSTEM	2.1. Introduction to the financial system. 2.2. Interest and Discount. 2.3. Incomes. 2.4. Basic operations of passive. 2.5. Basic operations of active. 2.6. Financial products.
Subject 3: THE SYSTEM OF FINANCE	3.1 The financial function. 3.2 The investment in the company. 3.3 Sources of finance of the company.

Subject 4: THE SYSTEM OF PRODUCTION I: GENERAL APPEARANCES	4.1 Investigation, development and technological innovation. 4.2 Function of production. 4.3 Classification of the productive processes. 4.4 The economic programming of the production. 4.5. The productivity: indicators of productivity.
Subject 5: THE SYSTEM OF PRODUCTION II	5.1 The costs of production. 5.2 Capacity of production and location. 5.3 Control of inventories.
Subject 6: THE SYSTEM OF COMMERCIALISATION	6.1 The market. 6.2 The competition. 6.3 The system of commercialisation. 6.4 Marketing-*mix.
Subject 7: THE SYSTEM OF ADMINISTRACION	7.1. The system of direction. 7.2. Human resources. 7.3. The model of prevention of penal risks and the compliance officer.
PRACTICES OF THE MATTER	Practice 1: Typology and nature of the company. Practice 2: Business Surroundings. Practice 3: economic Structure-financial (I). Practice 4: economic Structure-financial (II). Practice 5: economic Structure-financial (III). Practice 6: Analysis of results. Practice 7: Investment I. Practice 8: Investment II. Practice 9: Productivity. Practice 10: Costs of production. Practice 11: Threshold of profitability or Deadlock. Practice 12: business Responsibility. Ethical in the businesses. Practice 13: business Diagnostic.

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	28	56	84
Laboratory practises	26	38	64
Multiple choice tests	0	0	0
Long answer tests and development	2	0	2

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

Methodologies

	Description
Master Session	Lesson magistral with material of support and audiovisual means.Realise an exhibition of the main contents of the matter so that the almno can understand the scope of the same and facilitate his understanding. Through this methodology the competencies CG8, CE5, CT2 are developed.
Laboratory practises	Development and resolution of practical cases by means of the use of suitable computer tools for the contents of the matter. The tools to use are inside the available software by the University or will be of free character. Through this methodology the competencies the CG4, CG8, CE5 are developed.

Personalized attention

Methodologies	Description
Master Session	In the sessions the professor will attend, will orient and will resolve the doubts to the students on the contents tackled in the theoretical classes. The students will have occasion to attend to the tutorías personalised in the dispatch of the professor in the schedule that the professors will establish to such effect in the principle of the course and that will publish. These tutorías are allocated to resolve the doubts and orient to the students on the development of the contents tackled in the theoretical classes, and in the practical classes. Likewise, also it will keep a constant communication between the educational and the alumnado through the Network by means of the platform Fear in Faitic.
Laboratory practises	In the classes of laboratory, the professor will guide and will assist to the students that will work in the classroom resolving cases and questions.

Assessment

	Description	Qualification	Training and Learning Results

Long answer tests and development	Final proof that can contain partial or totally the contents of the matter developed in the classes of theory and of practices, in base to the results given in the different proofs done during the course. The number of proofs along the cuatrimestre will be of 5 and to be able to approve the asignatura have to approve all, those that do not surpass will go with them to the examination of May or June. The final note will be the average of all. Those that do not present to all, indispensable condition to approve by partial will go to the final examination with all the matter.	100	B4 B8	C5	D2

Other comments on the Evaluation

Will offer two systems of evaluation: evaluation by partial and evaluation at the end of the cuatrimestre. In any one of the two systems of evaluation all the competitions of the matter remain evaluated.
1. Evaluation by partial: The evaluation by partial will consist of a group of proofs scheduled and developed along the course, and that will complete with an examination at the end of the cuatrimestre that will cover total or partially the asignatura (those that have approved the partial and they have presented to all will not have to go with them at the end). The students have right to review his proofs of continuous Evaluation. The proofs will consist in five examinations (subjects 0 and 1, subject 2, subject 3, subjects 4 and 5 and subjects 6 and 7) that will effect when finishing each group of subjects. Each one of them versará on the contents seen until the moment of realisation of the proof, so much in classes of theory as of practices, is by this that all the proofs will have the same weight. Likewise to be able to approve the asignatura, will have to assist to 9 of the 13 planned practices, as well as the resolve and send to each professor the resolution of the same. Himself The student has surpassed all the proofs (that is to say obtains like minimum qualification a 5), will remain exento of the realisation of the examination at the end of the cuatrimestre. The qualification that obtains the student in this case will be the half note ponderada of the scored, in case that it remain him any will present at the end and will save them the notes of the proofs approved, doing half with them for the final note. The student has right to know the qualification obtained in each task and his back review in a reasonable term after his realisation. Likewise, these tasks are not recoverable, that is to say, if a student can not realise them in the day stipulated the professor does not have the duty to repeat them. The qualification obtained in the tasks evaluables will be valid so only for the academic course in which they realise , being his final note the average of all the approved.
2. Students that do not opt by evaluation by partial. To the students that do not opt by the evaluation by partial will offer them a procedure of evaluation that allow them reach the maximum qualification. This procedure will consist in a final examination that include the contents developed in the classes of theory and of practices.
3. On the announcement of recovery for the announcement of recovery: If it has done the diverse examinations: it will have to examine of which has not surpassed, saving the note, in the supposition of have not approved all, until the extraordinary announcement of June/July, in which it will examine of the no approved only if it has not done them: it will have a final proof of all the asignatura. In both cases will have to have realised the practices that program along the course do or no the partial proofs, assisting to them.
4. Qualification of No Presented: A student will consider no presented if, did not participate in the final proof, except which have approved all the partial. In any another case, the student will consider presented and will receive his corresponding note.

All students who are not yet passed all the partial, have been submitted to all throughout the course, their mean mark is over 5.0, and not presented for the final exam will take note: 4,0.

Sources of information

Basic Bibliography

Bueno Campos, E., **Curso básico de economía de la empresa**, 2004,
Fernández Sánchez, E. y otros, **Iniciación a los negocios para ingenieros. Aspectos funcionales**, 2008,

Complementary Bibliography

Pérez Gorostegui, E., **Curso de introducción a la economía de la empresa**, 2009,
Suárez Suárez, A., **Curso de economía de la empresa**, 2001,

Recommendations

IDENTIFYING DATA

Physics: Fundamentals of Mechanics and Thermodynamics

Subject	Physics: Fundamentals of Mechanics and Thermodynamics			
Code	V05G300V01102			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Chiussi , Stefano			
Lecturers	Boutinguiza Larosi, Mohamed Chiussi , Stefano Fernández Doval, Ángel Manuel			
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.			

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 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
Master Session	22	22	44
Case studies / analysis of situations	6	12	18
Troubleshooting and / or exercises	15.5	46.5	62
Laboratory practises	9	13.5	22.5
Multiple choice tests	0.5	0	0.5
Short answer tests	1	0	1
Practical tests, real task execution and / or simulated.	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Master Session	Prior personal work: -Preliminary reading of the proposed bibliography on the subject. During the lectures: -Presentation of theoretical concepts. -Experimental demonstrations. -Audiovisual presentations. Ulterior personal work: -Revision of theoretical concepts. -Weak-point identification. -Consult the bibliography. Through this methodology, competencies CG3, CE3, CG5, CG6 are worked out.
Case studies / analysis of situations	Application of the theoretical concepts to simple cases and situations. During the lectures: -Solving of examples. Ulterior personal work: -Solving of cases and situations from the bibliography. -Identification of weak points which require tutorial aid. Through this methodology, competencies CG3, CE3, CG5, CG6 are worked out.
Troubleshooting and / or exercises	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 practises	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 attention

Methodologies	Description
Master Session	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: 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.
Case studies / analysis of situations	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: 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.
Troubleshooting and / or exercises	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: 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 practises	Questions will be solved by the lecturers in their respective tutorial-aid time. Tutorial aid will be given: 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	
Multiple choice tests	Multiple-choice questions about theoretical concepts. Solving of elementary cases and situations related to the topics in both the classroom and laboratory syllabi.	25	B3 B5 B6	C3
Short answer tests	Short answer questions about theoretical concepts. Solving of elementary cases and situations related to the topics in both the classroom and laboratory syllabi.	25	B3 B5 B6	C3
Practical tests, real task execution and / or simulated.	Practical tests: Solving of problems involving one or more theoretical topics. Execution of real and simulated measurements. Real- and simulated-measurement result processing.	50	B3 B5 B6	C3

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 end-of-semester assessment.

It will be assumed that a student chooses continuous assessment if he or she takes and hands the third assessment exercise in (see below) and that he or she chooses single end-of-semester 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 according to the following criterion, regardless of whether he or she takes the final test or not.

1) CONTINUOUS ASSESSMENT

Continuous assessment consists of the exercises detailed below in this guide which are not retakeable, i.e, if a student is not able to take them in the scheduled date the teaching staff will not be required to repeat them.

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 tests will be only valid for the academic term they have been obtained.

First assessment exercise:

a1) Experimental laboratory exercise comprising the execution of actual measurements and the processing of the results, consisting in taking the experimental laboratory class number 3, individually processing (during the last 30 minutes) the assessable results specified in the corresponding experiment guide and handing them in at the end of the class (mark: between 0 and 1 point).

Second assessment exercise:

b1) Combined test with multiple-choice and short-answer questions and exercises. Questions about theoretical concepts. Solving of elementary cases and situations related to the topics in the classroom syllabus (mark: between 0 and 1 point).

Length: 30 minutes during one of the theory or problem-solving lectures. Its date will appear in the assessment test schedule that the Academic Board of the Degree will approve.

Third assessment exercise:

c1) Experimental laboratory exercise comprising the execution of actual measurements and the processing of the results, consisting in taking the experimental laboratory class number 5, individually processing (during the last 30 minutes) the assessable results specified in the corresponding experiment guide and handing them in at the end of the class (mark: between 0 and 1 point).

Fourth exercise, continuous assessment final test:

Combined test with:

d1) questions and exercises, multiple-choice and short-answer questions, (mark: between 0 and 5 points distributed among them)

e1) solving of one or two problems, (mark: between 0 and 3.4 points distributed between them)

f1) solving of a problem comprising the execution of real or simulated measurements and the processing of the results (mark: between 0 and 1.6 points).

Length: 2 hours in the subject's official examination date.

Overall mark calculation.

g1) will be calculated as the sum of the marks obtained in blocks b1), d1) and e1) plus the lowest of 2 points and the sum of blocks a1), c1) and f1)

$g1 = b1 + d1 + e1 + \min\{ 2 , a1 + c1 + f1 \}$

The overall mark will be the lowest of 10 points or g1)

$\text{overall mark} = \min\{ 10, g1 \}$

2) SINGLE END-OF-SEMESTER ASSESSMENT

Final overall test:

Combined test with:

d2) questions and exercises, multiple-choice and short-answer questions, (mark: between 0 and 5 points distributed among them)

e2) solving of one or two problems, (mark: between 0 and 3.4 points distributed between them)

f2) solving of a problem comprising the execution of real or simulated measurements and the processing of the results (mark: between 0 and 1.6 points).

Length: 2 hours in the subject's official examination date.

Overall mark calculation:

g2) will be calculated as the sum of the marks obtained in blocks d2), e2) and f2)

g2 = d2 + e2 + f2

The overall mark will be g2)

overall mark = g2

3) RESIT

Resit exam:

Combined test with:

d3) questions and exercises, multiple-choice and short-answer questions, (mark: between 0 and 5 points distributed among them)

e3) solving of one or two problems, (mark: between 0 and 3.4 points distributed between them)

f3) solving of a problem comprising the execution of real or simulated measurements and the processing of the results (mark: between 0 and 1.6 points).

Length: 2 hours in the subject's official resit date.

Final mark calculation:

The students who did not pass the subject and attend the resit exam will obtain a mark according to the following criteria:

3A) Students who had chosen continuous assessment

g3A) will be calculated as the sum of the marks obtained in blocks b1), d3) and e3) plus the lowest of 2 points and the sum of blocks a1), c1) and f3)

g3A = b1 + d3 + e3 + min{ 2 , a1 + c1 + f3 }

The overall mark will be the lowest of 10 points or g3A)

overall mark = min{ 10, g3A }

3B) Students who had chosen end-of-semester assessment

g3B) will be calculated as the sum of the marks obtained in blocks d3), e3) and f3)

g3B = d3 + e3 + f3

The overall mark will be g3B)

overall mark = g3B

NOTES:

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

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

III) The mark scale is established on the understanding that the minimum overall mark 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,

Profesorado presente y pasado de la asignatura., **Guiones de las prácticas de «Física Fundamentos de Mecánica y Termodinámica»**, 2017-2018, 2017

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

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
Fundamentals of Acoustics Engineering/V05G300V01531

Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/V05G300V01104
Mathematics: Calculus 1/V05G300V01105

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

Informatics: Computer Architecture

Subject	Informatics: Computer Architecture			
Code	V05G300V01103			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Llamas Nistal, Martín			
Lecturers	Arriba Pérez, Francisco de Llamas Nistal, Martín Mikic Fonte, Fernando Ariel Santos Gago, Juan Manuel			
E-mail	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: Simplez. 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. Assembler languages
5. Typical conventional machine	Structural Model. Functional Model. Set of instuctions. Addressing modes, Assembler. Examples of programmes. Algortimez
6. Peripheral management	Types of peripherals. Management of variety. Models. Secondary memories. Interruptions. Service Rutines. ADM: justification.
7. Operating Systems	Operative Machine. Introduction to Operating Systems. Definition of an operating system. Interface operating system.
8. Data Bases	Introduction to Data Bases. Relational Model. Entity-relation model. Query languages. Introduction to SQL

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practises	22	27.5	49.5
Introductory activities	5	5	10
Troubleshooting and / or exercises	10	17.5	27.5
Master Session	12	24	36
Self-assessment tests	0	3	3
Practical tests, real task execution and / or simulated.	4	8	12
Short answer tests	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 practises	The course includes programming practices that will performed using a simple computer (SIMPLEZ) and a regular computer (ALGORITMEZ). 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.
Troubleshooting and / or exercises	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.
Master Session	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 attention	
Methodologies	**Description**
Master Session	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 practises	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.

Troubleshooting and / or exercises	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 tests	Exam questions will be available for students, in order to perform autoevaluation.	0	B3 B4	C2
Practical tests, real task execution and / or simulated.	They will realise three practical exercises in the laboratory of continuous evaluation, and other three short exercises in each turn of laboratory.	50	B3 B4	C2
Short answer tests	They will realise in theory roughly 12 exercises of continuous evaluation, divided in two parts.	50	B3 B4	C2

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

And 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 scores in two different assessment 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)

}

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)

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

Both parts can be evaluated by Continuous Evaluation (CE) or by Final Exam (FE).

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

CE will consist of the tasks described in this guide, and 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 subject parts (Theory or Practice) is passed in the final semester examinations, its grade will be kept for the remedial exams where the student only must be evaluated of the other part. If the student has followed CE in part that remains, he/she will keep the grades.

The CE 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 subparts: T1 and T2. T1 covers approximately 66% of the syllabus (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.

*CONTINUOUS EVALUATION (CE):

In CE, the student needs to do short exercises (around 10 or 15 minutes) during the weekly class time. The grade in T1 and T2 is calculated using arithmetic average of the (approximately) 7 and 5 exercises proposed for each part. All of these exercises will take place in the classroom and never during the exam period. If a student does not assist to some of these exercises, this will not be repeated.

The theory CE grade is TG=MA(T1,T2);

If the student does not pass the CE but pass T1 or T2, he/she can attend to the examination of the failed part. In this way, The T1 and T2 grades will be kept for remedial examinations.

*SEMESTER FINAL EXAM

Any student, whether or not has followed the CE, can take the Final Exam. If the student followed the CE, he/she may discard the results obtained there, and take the Final Exam . In this case, the valid grade will be the FE, cancelling the grades that he/she had been obtained previously in the CE.

If the student does not pass the CE but pass T1 or T2, he/she can attend to the examination of the failed part. In this way, the grade obtained in CE is deleted, keeping the grade in the passed CE part. The calculation grade in theory is similar to the CE: TG=MA(T1,T2);

This Final Exam will have two exercises (T1 and T2) to be done in 90 minutes and it has a global subject quiz exam (TEST) to be done in 20 minutes.

The final score is:

TG =0,8*MA(T1, T2) + 0,2*TEST

If CE was not followed, the student will have to do T1, T2 and TEST exercises.

* REMEDIAL EXAMS

The Theory Remedial Exam has the same structure as in the Semester Final Exam.

If CE was not followed, the student will have to do T1, T2 and TEST exercises, regardless of the grades in each exercise in Final Semester Exam.

If CE was followed, the student can do the Semester Final Exam , cancelling the grade that he/she had previously obtained in CE.

If the student does not pass the CE but pass T1 or T2, he/she can attend to the examination of the failed part. In this way, the grade obtained in CE is deleted, keeping the grade in the passed CE part. The calculation grade in theory is similar to the AC: TG=MA(T1,T2);

PRACTICE

*CONTINUOUS EVALUATION:

The CE of Practice consists of 3 exercises P1, P2 and P3 . P1 will be about Simplez, P2 about Basic Algoritmez (over 60% of the syllabus) and P3 about Full Algoritmez (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 CE than for those who decide to go by FE). P1 and P2 will be held in afternoon shifts.

During the laboratory days, short exams are performed (approximately 30 minutes). These exercises will take place in (approximately) 2 (E1), 6 (E2) and 10 (E3) weeks.

The Practice CE grade is the weighted average of these exercises:
PG=0,07*E1+0,15*P1+0,08*E2+0,27*P2+0,09*E3+0,34*P3

*SEMESTER FINAL EXAM

Any student, whether or not has followed the CE, can take the Final Exam. If the student followed the CE, he/she may discard the results obtained there, and take the Final Exam . In this case, the valid grade will be the FE, cancelling the grades that had been obtained previously in the CE.

This Final Exam will have one exercise about Algoritmez to be done in the laboratory in 1 hour (approximately).

In this case, the Practice Grade is the grade of the Final Exam.

* REMEDIAL EXAM

The student will have a Remedial Exam similar to the Semester Final Exam.

GENERAL ISSUES

All exercises and exams of the subject are scaled from 0 to 10

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

EXAMS: To perform any theory exam (CE1, CE2, T1 and T2) or practice (P1, P2, P3 and Final Exam), including remedial exams, all students must register through the corresponding software tool, for which it will be notified with a minimum term of 5 calendar days.

Note: Prior to an exercise or an exam, the date and procedure for the score 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: All students are expected to have an ethical behaviour 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 behaviour: 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**,

Recommendations

IDENTIFYING DATA				
Mathematics: Linear algebra				
Subject	Mathematics: Linear algebra			
Code	V05G300V01104			
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	
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		
To know of the basic techniques of linear algebra and matrix algebra which are needed in other subjects that should be studied subsequently in the programme.	B3 B4	C1	D2 D3
Skill development the basic operations of matrix algebra.	B3 B4	C1	D2 D3
Knowledge of numerical methods for solving systems of linear equations and knowledge of the basic concepts involving vector spaces and linear maps.	B3		D3
Knowledge of the properties of vector spaces with inner product.		C1	
Skill development some applications of linear algebra: the method of least squares, singular value decomposition and classification of quadratic forms	B3	C1	D3
To know the arithmetic of complex numbers.	B3 B4	C1	D2 D3

Contents	
Topic	
Topic 1. Complex numbers.	Operations with complex numbers. Geometric concepts associated with complex numbers. Euler's formula and its consequences.
Topic 2. Matrices, 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 practises	2	2	4
Master Session	38	76	114
Troubleshooting and / or exercises	9	9	18
Troubleshooting and / or exercises	5	5	10
Long answer tests and development	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 practises	Solving assigned exercises and model problems. Use of the computer tool MATLAB. Through this methodology the competences CG3, CG4, CE1, CT2 and CT3 are developed.
Master Session	Explanation and development by the teacher of the contents of the various topics in the syllabus. Through this methodology the competences CG3, CE1 and CT3 are developed.
Troubleshooting and / or exercises	Resolution by part of the professor of suitable exercises adapted to each topic. The students will also have to take part in the resolution of exercises in order to strengthen their knowledge. Through this methodology the competences CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized attention

Methodologies	**Description**
Troubleshooting and / or exercises	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 practises	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.
Master Session	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**
Troubleshooting and / or exercises	Personalized attention will be available for assistance in the revision of tests and exams.

Assessment

	Description	Qualification	Training and Learning Results	
Troubleshooting and / or exercises	Continuous evaluation consists in four short tests to be given in the class hour and also on homework to be turned-in in class. The approximate planning will be the following: Four one hour tests: 1. Test of topic 1 (week 3 approximately). 2. Test of topic 2 and 3 (week 8 approximately). 3. Test of topic 4 (week 11 approximately). 4. Test of topic 5 (week 15 approximately). Each of these tests will have a weight of 10% in the final grade. Homework will 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%.	50	B3 B4	C1

Long answer tests and development	A written two-hour exam of topics 1, 2, 3, 4, and 5 at the end of the semester in date, time and venue determined in the official exams calendar of the School.	50	B3 B4	C1

Other comments on the Evaluation

Continuous evaluation:

A student chooses to be graded by continuous evaluation when, after knowing his grade in the first test (topic 1), accepts being evaluated by that method. 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.

End-of-semester evaluation:

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). This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

July evaluation:

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. Again, the passing grade cutoff will be 5.

The students who choose to be graded exclusively by the second final will write an exam (which will not be necessarily the same as the one for the students who made the opposite choice) 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.

The final grade of a student is the maximum of the grade obtaines by continuous evaluation and the mark obtained in the final exam. A passing grade is the one that is greater or equal to 5.

"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.

Éthical 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/V05G300V01201
Physics: Fields and Waves/V05G300V01202
Mathematics: Calculus 2/V05G300V01203
Mathematics: Probability and Statistics/V05G300V01204
Digital Signal Processing/V05G300V01304
Computer Networks/V05G300V01403

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 1/V05G300V01105

IDENTIFYING DATA				
Mathematics: Calculus 1				
Subject	Mathematics: Calculus 1			
Code	V05G300V01105			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Calvo Ruibal, Natividad			
Lecturers	Calvo Ruibal, Natividad Fernández Manin, Generosa González Rodríguez, Ramón			
E-mail	nati@dma.uvigo.es			
Web	http://faitic.uvigo.es			
General description	The aim that pursue with this subject is that the student know the basic technicians of the differential calculation in one and several real variables and his applications. Al term of this subject it expects that the student have achieved the understanding of the basic concepts of the differential calculation in one and several variables, the handle of the usual differential operators of the mathematical physics and of the technicians of differential calculation for the research of extremes, local approximation of functions and numerical resolution of systems of equations. Besides, it will have to know handle some computer program 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	
Subject 1. Introduction.	Sets of numbers and functions of one variable.
Subject 2. n-dimensional space.	Scalar product, norm. Vectorial product. Polar, cylindrical and spherical coordinates.

Subject 3. Continuity of functions of one variable.	Limit of a function in a point. Lateral limits. Continuity. Theorem of the intermediate value. Theorem of Bolzano. Method of bisection.
Subject 4. Continuity of functions of several variables.	Functions of several variables. Limits. Continuity. Theorem of Bolzano.
Subject 5. Derivation of functions of one variable.	Derivation of a function in a point. Derivative function, derivative successive, properties. Rule of the chain. Implicit derivation. Derivation of reverse functions.
Subject 6. Applications of the derivative.	Maxima and minimum. Theorem of the mean value. Rule of L'Hopital. Local study of the graphic of a function. Taylor polynomial. Method of Newton.
Subject 7. Differential of functions of several variables.	Directional derivatives. Partial derivatives. Jacobian matriz. Rule of the chain. Higher order derivatives. Differential operators.
Subject 8. Applications of the differential calculation.	Extreme values. Extreme values with equality constraints. Method of Newton.

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	38	66.5	104.5
Troubleshooting and / or exercises	10	14	24
Laboratory practises	2	1.5	3.5
Troubleshooting and / or exercises	4	8	12
Troubleshooting and / or exercises	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
Master Session	The professor will expose the theoretical contents of the matter. Through this methodology the competencies CG3, CE1 and CT3 are developed.
Troubleshooting and / or exercises	The professor will resolve problems and exercises of each one of the subjects and the student will have to resolve similar exercises. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.
Laboratory practises	The students will use computer tools (Maxima and/or Matlab) to resolve exercises and apply the knowledge purchased in the theoretical classes. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized attention

Methodologies	Description
Master Session	The professor will attend personally the doubts and queries of the students in the schedule of tutorías or by means of email.
Troubleshooting and / or exercises	The professor will attend personally the doubts and queries of the students in the schedule of tutorías or by means of email.

Assessment

	Description	Qualification	Training and Learning Results	
Troubleshooting and / or exercises	First session (1 hour): Subject 1. (Aprox. week 4). Second session (1 hour): Subjects 2, 3 and 4. (Aprox. week 8). Third session (1 hour): Subjects 5 and 6. (Aprox. week 11). Fourth session (1 hour): Subject 7. (Aprox. week 14). The four previous sessions add 50% of the total note.	5 17.5 10 17.5 50	B3 B4	C1

Troubleshooting and / or exercises	Final examination on the subjects 7 and 8 of the matter. The punctuation will be 50% of the total note.	50	B4	C1

Other comments on the Evaluation

1. Continuous evaluation

A student has opted by the continuous evaluation when he delivers to the teacher (before September 22) the sheet of registration in this type of evaluation. It will not be able to change the option of evaluation. If a student 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.

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

N = (1/10) x C + (5/10) x E

C: qualification, between 0 and 50, obtained as the sum of the qualifications of the four sessions of an hour.

E: qualification, between 0 and 10, obtained in the final examination on the subjects 7 and 8 of the matter.

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

2. Evaluation at the end of the semester

The students who do not choose to be graded by continuous evaluation, will be graded by means of a final exam (subjects: 1, 2, 3, 4, 5, 6, 7, and 8) and which will not be necessarily the same as the one for the students who choosed continuous evaluation. This exam will be graded in a scale of 10 points and the passing grade cutoff will be 5.

3. Second chance

The students who at the end of the semester do not obtain a passing grade will have the opportunity of writing a second final exam on date, time and venue determined in the official exams calendar of the School. 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= (1/10) x C + (5/10) x D

C: Note, between 0 and 50, obtained as the sum of the qualifications of the sessions of an hour.

D: Note, between 0 and 10, obtained in an examination on the subjects 7 and 8 of the matter.

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

The students who choose to be graded exclusively by the second final will write an exam (subjects: 1, 2, 3, 4, 5, 6, 7, and 8) and which will not be necessarily the same as the one for the students who made the opposite choice. This exam will be graded in a scale of 10 points and the passing gradecutoff will be 5.

4. Qualification of '' Not Present''

A student will obtain a qualification of ''Not Present'' if he did not choose the continuous evaluation and he 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 issue of the corresponding report for the School Director's Office.

Sources of information

Basic Bibliography

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

E. Marsden y A.J. Tromba, **Cálculo vectorial**, 5ª edición,

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Physics: Analysis of Linear Circuits/V05G300V01201
Physics: Fields and Waves/V05G300V01202
Mathematics: Calculus 2/V05G300V01203
Mathematics: Probability and Statistics/V05G300V01204
Digital Signal Processing/V05G300V01304
Electromagnetic Transmission/V05G300V01303

Subjects that are recommended to be taken simultaneously

Mathematics: Linear algebra/V05G300V01104

IDENTIFYING DATA				
Physics: Analysis of Linear Circuits				
Subject	Physics: Analysis of Linear Circuits			
Code	V05G300V01201			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García-Tuñón Blanca, Inés			
Lecturers	Cardenal López, Antonio José García Mateo, Carmen García-Tuñón Blanca, Inés Gómez Araújo, Marta Prol Rodríguez, Miguel			
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 and Fourier transforms).			

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	
Presentation and introduction.	
I: Continuous Response (RPC)	Fundamental and derived magnitudes. Active and passive elements and their functional relationships. Kirchhoff's laws. Analysis by the technique of mesh voltages. Analysis by the techniques of node currents. Simplifying techniques; Thévenin and Norton equivalent circuits.

II: Steady-state sinusoidal response (RSP)	Definition and parameters. Concepts of phasor and impedance. Mesh and node analysis of steady-state sinusoidal regime networks. Divisor circuits. Autoinductance and mutual inductance. Linear and ideal transformers. Power expressions. Thévenin and Norton equivalent circuits.
III: Two-ports	Definition of a two-port circuit. Characteristic parameters. Combining two-ports. A two-port in a circuit.
IV: Transient Response (RT)	Transient regime origin. Conditions of study. Inductors and capacitors in steady-state continuous regime. Single reactive element networks. Two reactive elements networks.
V: Signals and systems	lasses of signals. Some relevant signals: step function, unit impulse function, exponential function, sinusoidal function. Classes of systems. System properties; linear, time invariant systems; response to impulse.
VI: Laplace transform (TL)	Definition. Direct transforms. Inverse transform determination. Application to linear circuits. The transference function. Steady-state response in a circuit. Response for a sinusoidal input.
VII: Frequency domain analysis (RF)	Filter concept. Filter classes. Filter responses. Periodic signals.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Master Session	24.5	49	73.5
Practice in computer rooms	22	22	44
Laboratory practises	3	3	6
Troubleshooting and / or exercises	3	9	12
Practical tests, real task execution and / or simulated.	1	3	4
Long answer tests and development	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.
Master Session	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.

Practice in computer rooms	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. Al 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 practises	Two practical sessions will be carried out in the hardware lab, assembling and measuring circuits tasks will be covered. A total of 4 hours, with 1 hours dedicated to the evaluation of these sessions. Through this methodology the competencies CG3, CG4 and CE4 are developed.

Personalized attention

Methodologies	Description
Master Session	Needs and study matter queries of students will be addres by the professors on tutoring hours.
Laboratory practises	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.
Practice in computer rooms	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	
Troubleshooting and / or exercises	Three tests will take place in Group A timetable. They are expected to be carried out in week 6 (ECA1 Chapter 1), 10 (ECA2 Chapters 2 to 4) and 15 (ECA3 Chapters 5 to 7). The mark of each of these tests will be: 1.5, 3.0 and 2.5 points respectively. Three tests will take place in Group B timetable. They are expected to be carried out in week 4(ECB1), 8 (ECB2) and 15 (ECB3). The mark of each of these tests will be 0.5 ponits.	85	B3 B4	C4
Practical tests, real task execution and / or simulated.	There will be one test/task (ECHW) related to assembling and measuring circuits. The test will be carried out in Group B timetable. This test is expected to be carried out in week 12 with a maximum mark of 1.5 points. The following skills will be evaluated: teamwork, fit to design specifications and presenting results.	15	B3 B4	C4
Long answer tests and development	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 B4	C4

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 opportunity at the end of the semester. The student is free to choose the continuous evaluation system above described, without excluding the possibility to do a final exam. Possible cases:

- Students only doing the continuous evaluation: they are graded with the points obtained in the evaluation.
- Students doing both the continuous evaluation 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. Extraordinary exam. 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.
- HW sessions attendance will be mandatory.
- 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.

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/V05G300V01203

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G300V01104
Mathematics: Calculus 1/V05G300V01105

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				
Physics: Fields and Waves				
Subject	Physics: Fields and Waves			
Code	V05G300V01202			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Pino García, Antonio			
Lecturers	Gómez Araújo, Marta González Valdés, Borja Obelleiro Basteiro, Fernando Pino García, Antonio Rubiños López, José Óscar Vera Isasa, María			
E-mail	agpino@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Fields and Waves presents the first contact in the student's degree with the phenomena of electromagnetic waves, which are the physical medium for transmission of information at almost instantaneous speed. Mathematical modeling of electromagnetic fields that provide insights into the behavior of electromagnetic waves in real environments will be introduced.			

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
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
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		
Resolve problems applying the laws of Ampère, Gauss and Faraday.	B3	C1 C3	D3
Know and apply the Maxwell Equations	B3	C1 C3	D3
Calculate the main parameters of the electromagnetic waves: frequency, wavelength, propagation constant, polarization, Poynting vector, phase constant, attenuation constant.	B3	C3	D3
Analyze the propagación of waves in media with and without losses.	B3	C3	D3

Contents	
Topic	
1. Vector and differential analysis of fields	1.1 Scalar and vector fields 1.2 Systems of coordinates in space 1.3 Vector Algebra 1.4 Integral Operators 1.5 Differential operators 1.6 Properties of operators
2. Electrostatic fields	2.1 Sources of the electrostatic field 2.2 Equations of the electrostatic field, electric potential 2.3 Electrostatic fields produced by charge distributions 2.4 Equations of Poisson and Laplace 2.5 Electrostatic field in material media

3. Magnetostatic fields	3.1 Sources of magnetostatic field 3.2 Magnetostatic field equations 3.3 Magnetostatic field produced by current distributions 3.4 Magnetostatic filed in material media
4. Maxwell Model	4.1 Maxwell's equations in integral form 4.2 Differential form of Maxwell's equations 4.3 Boundary conditions. 4.4 Energy balance of the electromagnetic field 4.5 Harmonic time variation 4.6 Harmonic time variation in material media
5. Wave equation and its solutions	5.1 Wave equation for time harmonic fields 5.2 Propagation, attenuation and phase constants 5.3 Solutions in rectangular coordinates 5.4 Progressive, stationary and evanescent waves in lossy and losseless media
6. Uniform plane waves	6.1 Expressions of the fields 6.2 Characteristic impedance 6.3 Poynting Vector 6.4 Polarization
7. Waves in the presence of obstacles	7.1 Incident wave, scattered wave and transmitted wave 7.2 Standing waves 7.3 Standing wave pattern 7.4 Polarization and power

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	16	24	40
Case studies / analysis of situations	21	31.5	52.5
Practice in computer rooms	4	6	10
Troubleshooting and / or exercises	12	18	30
Multiple choice tests	1	4.5	5.5
Long answer tests and development	2	10	12
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Master Session	Exhibition by the professor of the contents on the matter object of study, theoretical bases and/or guidelines of a work, exercise or project to develop by the student. Through this methodology the competencies CG3, CE1 and CT3 are developed.
Case studies / analysis of situations	Analysis of a fact, problem or real event with the purpose to know it, interpret it, resolve it, generate hypothesis, contrast data, think about it, complete knowledges, diagnose it and train in alternative procedures of solution. This metodology will be used both in large and medium size groups. Through this methodology the competencies CG3, CE1, CE3 and CT3 are developed.
Practice in computer rooms	Activities application of knowledge to specific situations, and the acquisition of basic skills and procedural matters related to the object of study, which are held in computer rooms. Electromagnetic simulators will be used. Through this methodology the competencies CG3, and CE3 and are developed.
Troubleshooting and / or exercises	Problems and/or exercises related with the subject are formulated. The student has to develop the suitable or correct solutions by development of routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results. It is a complement of the lectures. Through this methodology the competencies CG3, CE1, CE3 and CT3 are developed.

Personalized attention

Methodologies	Description
Master Session	The student will receive personalized attention during the tutoring hours.
Troubleshooting and / or exercises	The student will receive personalized attention during the tutoring hours.
Case studies / analysis of situations	The student will receive personalized attention during the tutoring hours.
Practice in computer rooms	The student will receive personalized attention during the tutoring hours.

Assessment

	Description	Qualification	Training and Learning Results	
Troubleshooting and / or exercises	Proof in which some problems and/or exercises related with the subject are formulated. The student has to develop the suitable or correct solutions by development of routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results.	35	B3	C1 C3
Multiple choice tests	Tests for assessment of acquired skills that include questions with response alternatives (true / false, multiple choice, matching elements ...). Students select an answer from a limited number of possibilities.	5	B3	C1 C3
Long answer tests and development	Proof for evaluation of the skills that includes open questions on a subject. The students have to develop, relate, organise and present their knowledge about the subject in an extensive answer.	60	B3	C1 C3

Other comments on the Evaluation

Following the policy guidelines of the Center, the students can choose between two systems of evaluation: continuous evaluation and evaluation at the end of the term.

In all the evaluation tests, the competences CG3, CE1 and CE3 will be evaluated.

1. CONTINUOUS EVALUATION.

- The system of continuous evaluation (EC) will consist of:
    - a) A problem solving test that will be taken around the 4th week of the term. The qualification will be ECa, with maximum score of 0.5 points.
    - b) A multiple choice test that will be taken around the 8th week of the term. The qualification will be ECb, with maximum score of 0.5 points.
    - c) a problems/questions solving test on units/topics 1, 2 and 3 of he syllabus. It will be taken around the 8th week of the term. The effective qualification will be ECc=(4-ECa-ECb)·X/10, where X is the score of this last test in a range from 0 to 10.
- The final qualification of the continuous evaluation (EC) will be obtained as EC1=ECa+ECb+ECc, with a maximum score of 4 points. This way of qualification makes that the student arriving to the test "c" has as minimum Eca+Ecb and he/she can obtain up to 4 points with the test "c".
- Before the completion or delivery of the test, the date and procedure for the review of the obtained grades will be indicated. Students will have the option to know the status of the test and review the correction within a reasonable period of time.
- This test is not recoverable, what means that if a student cannot fulfill it in the stipulated period and terms, teachers will not be committed to repeat it.
- The grade obtained in the continuous evaluation test (EC1) will be valid only for the current academic course.
- It will be understood that a student follows the EC system whenever he takes any of the tests "b" or "c" of the continuous evaluation.

2. END OF THE TERM EXAM

- All the students must take this exam in order to pass the course on first call.
- Students that did not follow the continuous evaluation: their final score will be that of the complete final exam (EF).
- Students that followed the continuous evaluation:
    - They will take only the part of exam corresponding to topics 4 to 7 (EX2), that will be graded from 0 to 6 points and will be saved as the second part of the continuous evaluation (EC2) until the Recovery exam of July (EC2 = EX2).
    - The final score will be EF=EC1+EC2

3. RECOVERY EXAM.

- Students that did not follow the continuous evaluation: the final score will be that of the complete final exam (EF).

- Students that followed the continuous evaluation.
    - The recovery exam will also be divided in two parts: EX1 (topics 1 to 3) with a maximum value of 4 points, and EX2 (topics 4 to 7) with a maximum value of 6 points.
    - The students that followed the continuous evaluation will choose to do: only EX1, only EX2, or both parts. The final grade will be: EF = max(EX1, EC1) + max(EX2, EC2), being EX1 and EX2 the grades obtained in each part of the recovery exam, and EC1, EC2 as described before.

4. NOTES

- It is considered that a student has taken the course when he/she has followed the continous evaluation or has taken any of the two exams (end of term exam or recovery exam). If an student who followed continuous evaluation does not take any of the other two exams (end of term/recovery) he/she will be graded with EC1.
- In order to pass the course, students must receive a grade of 5 or above.

Sources of information
Basic Bibliography
F. T. Ulaby, U. Ravaioli, **Fundamentals of Applied Electromagnetics**, Global Edition 7/e, Pearson Education Limited, 2015
D. K. Cheng, **Fundamentos de Electromagnetismo para Ingeniería**, Addison Wesley, 1998
Complementary Bibliography
D. K. Cheng, **Fundamentals of Engineering Electromagnetics**, New International Edition, Pearson, 2013
J. R. Reitz, F. J. Milford, R. W. Christy, **Fundamentos de la Teoría Electromagnética**, 4ª Edición, Addison Wesley, 1996
David J. Griffiths, **Introduction to Electrodynamics**, 4ª Edición, Pearson Education Limited, 2012
F. Dios, D. Artigas, et all., **Campos Electromagnéticos**, Ediciones UPC, 1998
W. H. Hayt, J. A. Buck, **Teoría Electromagnética**, 8ª Edición, Mc Graw Hill, 2012
D. K. Cheng, **Field and Wave Electromagnetics**, 2ª Edición, Addison Wesley, 1998
M. F. Iskander, **Electromagnetic Fields and Waves**, 2ª Edición, Prentice Hall, 2012

Recommendations
Subjects that continue the syllabus
Electromagnetic Transmission/V05G300V01303
Subjects that are recommended to be taken simultaneously
Mathematics: Calculus 2/V05G300V01203
Subjects that it is recommended to have taken before
Mathematics: Linear algebra/V05G300V01104 Mathematics: Calculus 1/V05G300V01105

IDENTIFYING DATA				
Mathematics: Calculus 2				
Subject	Mathematics: Calculus 2			
Code	V05G300V01203			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Martínez Varela, Áurea María			
Lecturers	Fernández Manin, Generosa García Lomba, Guillermo Martínez Varela, Áurea María Prieto Gómez, Cristina			
E-mail	aurea@dma.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.			

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 the basic theory of integration of functions of one and several variables.	B3 B4	C1	D2 D3
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

Contents
Topic

Theme 1. Integral calculus in R.	The Riemann integral Integrable functions. The fundamental theorem of the integral calculus. The theorem of the half 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. The multiple integral in the sense of Riemann.	The double and triple integrals in elementary regions. Change of the order of integration. Theorems of change of variable. Cylindrical and spherical coordinates. Applications.
Theme 4. Orthogonal functions and Fourier series.	Orthogonal functions. Fourier series. Developments of Fourier series for odd and even functions. Convergence. The Fourier transform.
Theme 5. 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 6. 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 7. The Laplace transform.	Definition of the Laplace transform. Properties. Application to the solution of differential equations.

Planning

	Class hours	Hours outside the classroom	Total hours
Troubleshooting and / or exercises	17	17	34
Laboratory practises	3	6	9
Master Session	28	56	84
Troubleshooting and / or exercises	7	14	21
Practical tests, real task execution and / or simulated.	1	1	2

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

Methodologies

	Description
Troubleshooting and / or exercises	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 practises	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.
Master Session	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 attention

Methodologies	Description

Master Session	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 the Web page of the department.
Troubleshooting and / or exercises	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 the Web page of the department.
Laboratory practises	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 the Web page of the department.

Assessment

	Description	Qualification	Training and Learning Results	
Troubleshooting and / or exercises	Five "one hour sessions". 1st session: Theme 1 (4th week aprox.) 2nd session: Theme 3 (8th week aprox.) 3rd session: Theme 4 (11th week aprox.) 4th session: Theme 5 (13th week aprox.) 5th session: Theme 6 (15th week aprox.) These five sessions account for 35% of the score with the following weights: First: 10% (1 point) Second: 10% (1 point) Third: 5% (0,5 points) Forth: 5% (0,5 points) Fifth: 5% (0,5 points) Final exam: 60% (6 points)	95	B3 B4	C1
Practical tests, real task execution and / or simulated.	The students will do a practice of laboratory of the Theme 2 using MATLAB or MAXIMA (8th week aprox.) Its value will be of 5% (0,5 points)	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.

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 six sessions of the items 1, 2, 3, 4, 5 and 6.
E: Note of the final examination of the items 3, 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.

Previously to the exam students who chose continuous assessment may choose, if desired, for an exam of the items 3, 5, 6 and 7. The final grade is obtained as

NR = C + ER

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

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 are recommended to be taken simultaneously

Physics: Analysis of Linear Circuits/V05G300V01201
Physics: Fields and Waves/V05G300V01202
Mathematics: Probability and Statistics/V05G300V01204

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G300V01104
Mathematics: Calculus 1/V05G300V01105

IDENTIFYING DATA				
Mathematics: Probability and Statistics				
Subject	Mathematics: Probability and Statistics			
Code	V05G300V01204			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Fernández Bernárdez, José Ramón			
Lecturers	Alonso Alonso, Ignacio Fernández Bernárdez, José Ramón Mojón Ojea, Artemio Oya Díez, Simón Prol Rodríguez, Miguel			
E-mail	jramon.fernandez@uvigo.es			
Web	http://faitic.uvigo.es			
General description	In this subject we review 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 the large numbers. Central limit theorem.
Stochastic processes	Description of a stochastic process. Statisticis of a stochastic process. Stationarity. Examples.

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	24	24	48
Troubleshooting and / or exercises	13.5	28	41.5
Practice in computer rooms	14	7	21
Troubleshooting and / or exercises	1.5	6	7.5
Multiple choice tests	0.5	2	2.5
Other	0.5	1	1.5
Long answer tests and development	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
Master Session	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.
Troubleshooting and / or exercises	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.
Practice in computer rooms	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 attention

Methodologies	Description
Master Session	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.
Troubleshooting and / or exercises	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.
Practice in computer rooms	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	
Troubleshooting and / or exercises	Students must solve a problem, two occasions along the course	25	B3 B4	C1

Multiple choice tests	The students must answer a test.	12.5	B3 B4	C1
Other	Students must solve a problem. (part 1) In a later class, each student will correct a problem made by somebody else (part 2).	12.5	B3 B4	C1
Long answer tests and development	Final exam.	50	B3 B4	C1

Other comments on the Evaluation

Following the guidelines of the studies, two evaluation systems will be offered to the students inscribed on this subject: continuous evaluation and evaluation at the end of the semester.

The continuous evaluation consists of several tasks.

A student follows the continuous evaluation system if she/he participates in task 2 (approximately in the seventh week of the semester) or any later task. Task 1 (both, part 1 and part 2) may be performed without opting for the continuous evaluation.

Students who choose continuous evaluation:

Several tasks are evaluated. The approximate task calendar and the weight of each task in the final grade are listed below.

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

Part 1: Individual resolution of a problem. Week 4

Part 2: Correction of the task 1(part 1) from somebody else. Week 5

Task 2: Individual resolution of a test. Weight 12.5%. Week 10

Task 3: Individual resolution of a problem. Weight 12.5%. Week 12

Task 4: Individual resolution of a problem. Weight 12.5%. Week 14

The last task of the continuous evaluation will be a final exam. This will be a smaller version of the exam to be carried out by students who do not opt for continuous evaluation. The weight of the examination in the final grade will be 50 %

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

These tasks are not recoverable, what means that if a student cannot fulfill them in the stipulated period, teachers will not be committed to repeat them.

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

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

The final grade for students who opt for continuous evaluation will be calculated as the average between the final exam and 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 obtained grade.

Students who choose for evaluation at the end of the semester:

The possibility of a final examination will be provided to students who do not opt for the continuous evaluation. This exam will be rated between 0 and 10, and this will be the final grade obtained.

Second chance

Previously to the exam (or at its beginning), students will be asked to choose to be evaluated by continuous evaluation system (described before) or only by the final exam.

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

Sources of information

Basic Bibliography

JR Fernández, I. Alonso y A. Mojón, **Apuntes de Probabilidad y Estadística**, 8 ed, 2018

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/V05G300V01203

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G300V01104

Mathematics: Calculus 1/V05G300V01105

IDENTIFYING DATA				
Programming I				
Subject	Programming I			
Code	V05G300V01205			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Rodríguez Hernández, Pedro Salvador			
Lecturers	García Palomares, Ubaldo Manuel Pazos Arias, José Juan Ramos Cabrer, Manuel 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.			

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. The algorithm and its different representations: flowchart, pseudocode, natural language. 2. Algorithm implementation by means of a programming language. Programming paradigms: modular programming and structured programming. 3. C language and the function main(). Source code and object code. The compiler and the interpreter. 4. Input/output exercises: human-computer interface. The standard input/output files: stdin, stdout. The #include directive. Library functions.
Lecture 2: Grammar and basic elements of C language.	1. The alphabet. Recursive derivations of sintactically valid sequences. Identifiers, numbers. Symbolic constants: The #define directive and macros. Use of the const qualifier. 2. Variables and their attributes: name, value, address, types. Pointer variables. Declaration of simple variables and pointers: the direction & and reference * operators. 3. The sizeof operator. Arithmetical operators. The assignment operator. Automatic type conversion and by means of the cast operator. 4. Syntactic notation for expressions and statements. Simple and compound statements.
Lecture 3: Sequential, iteration and selection statements	1. Evaluation of expressions with relational operators and boolean operators. 2. Decision statements: switch, if, nested if. The ternary operator (?:) 3. The iterative statements and their importance in modular programming: while, do while and for. The break and continue statements.
Lecture 4: Arrays	1. Declaration of array variables. Memory allocation for multidimensional arrays. 2. Unidimensional arrays and pointers: pointer arithmetic. Arrays of characters: the end of string character. Library functions for dealing with arrays of characters. 3.Variable length arrays in standard C99. 4. Dynamic memory allocation for 1 and 2 dimension arrays: the malloc(), calloc(), realloc() functions.
Lecture 5: Functions	1. Functions declaration and definition. Local, static and global variables. Function return value. 2. Actual and formal parameters. Parameter passing by value and by reference: use of pointers. Command line arguments passing to function main( ). 3. Creation and use of function libraries. Library functions for strings handling. 4. Modular compilation. The conditional directives in a header file. 5. Recursive functions: advantages and disadvantages.
Lecture 6: struct variables	1. struct variables: global declaration. Fields of a struct. Pointers to struct. The . (Point) and -> (arrow) operators. 2. struct and a pointer to struct as a funcion parameter and return value. 3. typedef with non trivial declarations. 4. More complex data structures: nested structs, array of structs. 5. Dynamic management in creating linear lists, circular lists and trees. 6. Insertion and removal of variables in a list.
Lecture 7: Files	1. Text files: fopen() and fclose() functions. 2. Different file input/output functions: fprintf (), fscanf(), fgets(), feof(). 3. Functions with direct access to files. 4. Information management between files and lists. 5. Node structure in simple linked lists. 6. File to list conversion and vice versa.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Master Session	24	24	48
Laboratory practises	12	14	26
Projects	8	24	32
Practical tests, real task execution and / or simulated.	5	15	20
Other	5	15	20
Reports / memories of practice	0	2	2

*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.
Master Session	Plenary sessions that include the realisation of works and programs. Through this methodology the competencies CE12 and CT2 are developed.
Laboratory practises	During the first weeks of the term the student codifies, compiles and documents programs guided by the instructor. Some of these activities will be evaluated. Through this methodology the competencies CG4, CE12 and CT2 are developed.
Projects	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 attention	
Methodologies	**Description**
Master Session	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 practises	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.
Projects	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		
Projects	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 in the final laboratory test.	25	B4 B9	C6 C12	D4
Practical tests, real task execution and / or simulated.	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 comprehensive 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	
Other	Every 4 weeks, the student will take an exam that may consist of: - short answer questions - multiple choice questions - troubleshooting and / or exercises This exam will assess the student's mastership of the concepts introduced in the master sessions. At the end of the term, the student will take a comprehensive final exam on the whole contents of the subject.	50	B4	C12	
Reports / memories of practice	After the second week in the project development, the student will submit a description of its design, in the form of a pseudocode or a flowchart. At the end of the term, the student will submit a report, including the project's documentation.	5	B4	C12	D4

Other comments on the Evaluation

The **course planning in lectures** and the estimated time of the **most important assessment milestones** is detailed below:

- Week 1: Theory introduction + Lectures 1 and 2
- Week 2: Lecture 3 | Practice introduction + Practice 1
- Week 3: Lectures 3 and 4 | Practice 2
- Week 4: Lecture 4 + **Theory Test 1** (PT1) | **Laboratory Test 1** (PP1)
- Week 5: Lecture 4 | Practice 3

- Week 6: Lecture 5 | Practice 4
- Week 7: Lecture 5 | Practice 45
- Week 8: Lecture 5 + **Theory Test 2** (PT2) | **Laboratory Test 2** (PP2)
- Week 9: Lectures 5 and 6 | Practice 6
- Week 10: Lecture 6 | Practice fulfilment + Project (1h)
- Week 11: Lecture 6 | Project (2h) + Project design submission (psudocode or flowchart)
- Week 12: Lecture 7 + **Theory Test 3** (PT3) | Project (1h) + **Laboratory Test 3** (PP3)
- Week 13: Lecture 7 | Project (2h)
- Week 14: Project (2h)
- Before the final exams, project submission (coding and documentation)
- Finals: **Final Theory Test** (PTF) - **Final Laboratory Test** (PPF)

In all courses the School offers two evaluation modes: **Continuous evaluation** and **comprehensive evaluation**.
The student must opt to the latter one explicitily, no latter than the week before the Laboratory Test 2 (PT2) is taken.
The **continuous evaluation** will be considered as "passed" if both the student has submitted a report (design, coding and documentation) for the project developed from the 10th to the 14th week, and the final grade (NFC) obtained by the student is at least 5. This final grade is the harmonic mean between the theory and laboratory tests grades, calculated as follows:
NFC = (2*NTC*NPC)/(NTC+NPC)
where:

- Theory Grade by Continuous Evaluation: NTC = 0.1*PT1+0.1*PT2+0.2*PT3+0.6*PTF
- Practice Grade by Continuous Evaluation: NPC = 0.1*PP1+0.1*PP2+0.2*PP3+0.5*PPF+0.1*PDD

The Final Theory Test (PTF) is an exam that may consist of short answer questions and/or multiple choice questions and/or troubleshooting and/or exercises. It assesses the mastership of the contents introduced in the lectures.
The Final Practice Test (PPF) 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.
The **Design and Documentation Test** (PDD) assesses the quality of the pseudocode or the flowchart describing the project's design (submitted the 11th week), and project's documentation report submitted before the final exams
The use of the harmonic means implies that the course is not passed if either NPC or NTC has a grade under 3.3.
No test 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.
In order to pass the course by the **comprehensive evaluation mode**, the student must submit a project report (design, coding and documentation) similar to the one submitted by the continuous evaluation students, and the final grade obtained by the student must be at least 5. This mode will consist of the same exams as the continuous evaluation one (although with different weight in the final grade), that is, an exam that may consist of short answer questions and/or multiple choice questions and/or troubleshooting and/or exercises (PTF) and a laboratory test (PPF, which will include the evaluation of the project). The final grade is the harmonic mean between the theory and practice grades, calculated as follows:
NFF = (2*NTF*NPF)/(NTF+NPF)
where:

- Theory Grade by Comprehensive Evaluation: NTF = PTF
- Practice Grade by Comprehensive Evaluation: NPF = 0.9*PPF+0.1*PDD

Both the **continuous evaluation grade** (NFC) and the **comprehensive evaluation grade** (NFF) 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 Laboratory Test 1 (PP1)
- If the student opts for the comprehensive evaluation mode, when no final test (PTF and PPF) is taken.

University regulations allow students to take an additional test to approve the course (extra evaluation). In order to pass the course using this extra evaluation, the student must submit a project report (design, coding and documentation) similar to the one submitted by the continuous evaluation students, and the final grade obtained by the student must be at least 5. This extra evaluation will consist of an exam that may consist of short answer questions and/or multiple choice questions and/or troubleshooting and/or exercises (Extra Theory Test) and a laboratory test which will include the evaluation of the project (Extra Laboratory Test)). The final grade is the harmonic mean between the theory and practice grades, calculated as follows:
NFE = (2*NTE*NPE)/(NTE+NPE)
where:

- Theory Grade by Comprehensive Evaluation (NTE): if the student takes the Extra Theory Test, NTE will be the grade achieved in that test:

  NTE = PTE

  Otherwise, NTE will be the theory grade obtained for the theoretical tests in his/her regular evaluation.

- Practice Grade by Comprehensive Evaluation (NPE): if the student takes the Extra Laboratory Test, NPE will be the weighed additionof the grade achieved in that test plus the grade obtained inf the design and documentation test:

  NPE = 0.9*PPE+0.1*PDD
  Otherwise, NPE will be the practice grade obtained for the practical tests in his/her regular evaluation.

In both final and extra evaluation, and in both evaluation modes, in case of failure to fulfil the mandatory requirement of submitting the project report, the final grade (computed according to the corresponding formula) will be upper-bounded to a maximum value of 4.5 points.

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.

If plagiarism is detected in any of the works/test taken, the student will receive a failing grade (0) and the professors will report the fact to the school authorities.

Sources of information

Basic Bibliography

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

Brian W. Kernighan & Dennis M. Ritchie, **El Lenguaje de Programación C**, 1986 (reimpreso en 1995),

Complementary Bibliography

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**, 1997 (reimpreso en 2004),

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

Recommendations

Subjects that continue the syllabus

Programming II/V05G300V01302

Subjects that it is recommended to have taken before

Informatics: Computer Architecture/V05G300V01103

Other comments

Programming II course continues this course in the second year.