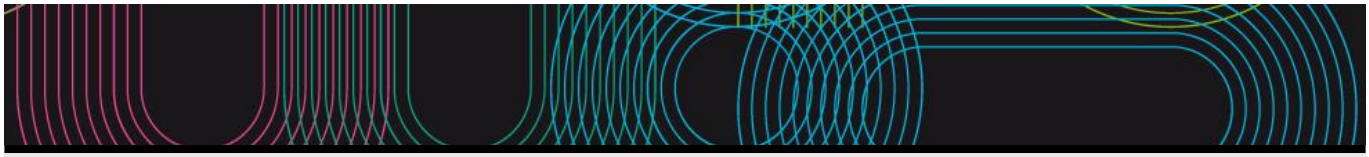

(*)Escola de Enxeñaría de Telecomunicación

(*)Páxina web

(*)

www.teleco.uvigo.es

(*)Presentación

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

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

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

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

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

Master in Telecommunication Engineering

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

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

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

Interuniversity Masters

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

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

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

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

(*)Equipo directivo

MANAGEMENT TEAM

Director: Íñigo Cuíñas Gómez (teleco.direccion@uvigo.es)

Subdirección de Relaciones Internacionales: Enrique Costa Montenegro (teleco.subdir.internacional@uvigo.es)

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

Subdirección de Organización Académica: Manuel Fernández Veiga (teleco.subdir.academica@uvigo.es)

Subdirección de Calidad: Loreto Rodríguez Pardo (teleco.subdir.calidade@uvigo.es)

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

BACHELOR□S DEGREE IN TELECOMMUNICATION TECHNOLOGIES ENGINEERING

General coordinator: Rebeca Díaz Redondo (teleco.grao@uvigo.es)

http://teleco.uvigo.es/images/stories/documentos/comisions/membros_comisions_grao.pdf

MASTER IN TELECOMMUNICATION ENGINEERING

General coordinator: Manuel Fernández Iglésias (teleco.master@uvigo.es)

http://teleco.uvigo.es/images/stories/documentos/comisions/membros_comisions_master.pdf

MASTER IN CYBERSECURITY

General coordinator: Ana Fernández Vilas (camc@uvigo.es)

http://teleco.uvigo.es/images/stories/documentos/comisions/membros_comisions_master_ciberseguridade.pdf

MASTER IN INDUSTRIAL MATHEMATICS

General coordinator: Elena Vázquez Cendón (USC)

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

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

INTERNATIONAL MASTER IN COMPUTER VISION

General coordinator: Xose Manuel Pardo López (USC)

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

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

Telecommunication Engineering

Subjects

Year 2nd

Code	Name	Quadmester	Total Cr.
V05M145V01301	Procesado de Sinal en Tempo Real	1st	5
V05M145V01302	Sistemas Avanzados de Comunicación	1st	5
V05M145V01303	Procesado Estatístico do Sinal	1st	5
V05M145V01304	Optimización Numérica en Telecomunicacións	1st	5
V05M145V01305	Modelos Matemáticos e Simulación Numérica	1st	5

V05M145V01306	Ténicas Criptográficas de Protección de Datos	1st	5
V05M145V01307	Machine Learning	1st	5
V05M145V01308	Administración de Redes e Sistemas	1st	5
V05M145V01309	Tecnoloxías para o Desenvolvemento Web	1st	5
V05M145V01310	Desenvolvemento de Aplicacións Móbiles	1st	5
V05M145V01311	Satélites	1st	5
V05M145V01312	Sistemas de Radio en Banda Larga	1st	5
V05M145V01313	Comunicacións Móbiles e sen Fíos	1st	5
V05M145V01314	Radionavegación	1st	5
V05M145V01315	Redes Ópticas	1st	5
V05M145V01316	Radar	1st	5
V05M145V01317	Deseño de Circuítos de Microondas e Ondas Milimétricas e CAD	1st	5
V05M145V01318	Seguridade Multimedia	1st	5
V05M145V01319	Sensores Intelixentes	1st	5
V05M145V01320	Laboratorio de Electrónica Dixital para Comunicacións	1st	5
V05M145V01321	Computación Distribuída	1st	5
V05M145V01322	Análise de Datos	1st	5
V05M145V01323	Redes Sociais e Económicas	1st	5
V05M145V01324	Prácticas en Empresas I	1st	5
V05M145V01325	Prácticas en Empresa II	1st	5
V05M145V01326	Prácticas en Empresas III	1st	5
V05M145V01327	Network Information Theory	1st	5
V05M145V01328	Aprendizaxe en Rede e Traballo Colaborativo	1st	5
V05M145V01329	Human-Computer Interaction	1st	5
V05M145V01330	Electrónica de Potencia en Fotovoltaica	1st	5
V05M145V01331	Acondicionadores de Sinal	1st	5
V05M145V01332	Implementación e Explotación de Equipos Electrónicos	1st	5
V05M145V01333	Laboratorio de Equipos Electrónicos	1st	5
V05M145V01334	Seminario de Telecomunicacións	1st	5
V05M145V01335	Transdutores Piezoeléctricos e Aplicacións	1st	5
V05M145V01336	Álxebra Lineal Numérica en Enxeñaría de Telecomunicación	1st	5
V05M145V01401	Traballo Fin de Máster	2nd	30

IDENTIFYING DATA				
Real-Time Signal Processing				
Subject	Real-Time Signal Processing			
Code	V05M145V01301			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Martín Rodríguez, Fernando			
Lecturers	Martín Rodríguez, Fernando			
E-mail	fmartin@uvigo.es			
Web				
General description	In this subject we deal with several architectures and techniques for real-time signal and video processing. Our main focus will be on hands-on, practical work and the capability to adapt to new, emerging, constantly evolving technologies and tools.			

Competencies	
Code	
CG1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE21	CE21/PS1 Manage implementation of signal processing systems options to accelerate computationally complex algorithms.

Learning outcomes	
Learning outcomes	Competences
Understanding the basic principles of real time signal and video processing.	CG1 CG8 CE21
Handling advanced programming tools for real-time signal and video and applications.	CG1 CG8 CE21
Understanding the design and implementation of computationally complex models generated from data (machine learning) and their use in real applications.	CG1 CG8 CE21
Knowing how to design the suitable software-hardware solution for a problem of signal processing with real-time restrictions.	CG1 CG8 CE21

Contents	
Topic	
Fundamentals of real-time signal and video processing	Real-time definitions Real-time processing platforms Software methods and algorithm simplifications
Design and implementation of real-time signal and video processing applications	Real-time constraints: from research to implementation. Practical examples for signal processing Practical examples for video processing
Highly demanding computational models learned from data	Machine learning principles Artificial neural networks and deep learning Typical DNN models and implementation Examples of highly demanding signal and video processing applications.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	12	0	12
Practices through ICT	8	25	33
Case studies	5	70	75
Report of practices, practicum and external practices	3	0	3
Problem and/or exercise solving	1.5	0	1.5
Presentation	0.5	0	0.5

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

Methodologies	
	Description
Lecturing	Description of the fundamental concepts and practical considerations for signal and video processing applicactions with real-time constraints. CG1
Practices through ICT	Individual practice work using computing platforms and/or simulators to implement and compare sotware solutions. CG1, CG8, CE21
Case studies	Individual or group practice work using computing platforms and/or simulators to study and implement specific applications. CG1, CG8, CE21

Personalized assistance	
Methodologies	**Description**
Practices through ICT	The instructor will propose practical exercises to grasp the concepts explained in class and related to the case studies. The professor will review with the student the design and the code of the student in each session.
Case studies	The instructor will propose a couple of case studies and the students will need to study them and implement different solutions. The students will need to make a written report and present the results to their classmates. The professor will guide the students but the work is mainly done by them.

Assessment				
	Description	Qualification	Evaluated Competencess	
Report of practices, practicum and external practices	Report on the study of the practical case and solution adopted .	70	CG1 CG8	CE21
Problem and/or exercise solving	Computer-based tests regarding the explained contents in master classes and concepts apeearing in the case studies.	20	CG1 CG8	
Presentation	The students will present, individally, their work related to the case studies	10	CG8	CE21

Other comments on the Evaluation

Teaching and assessment is in english.

Attendance is compulsory in continuous assessment, unless special circumstances are alleged. Continuous assessment will be based on short answer tests, case study reports and presentations.

There will be an official first-call exam scheduled by the "Xunta de Escola" that the students that didn't pass the continuous assessment will have to take if they want to pass the course. This final exam will be scored from 0 to 10 points and covers all the topics explained during the course and also concepts and techniques explained for the case studies. To pass this exam the student has to score, at least, 5 points.

Delivering any of the reports or sitting at any test will automatically mean that the student is following the course in the continuous assessment mode. That means that he/she will appear as "presented" in the records of the subject even if the first-chance exam is not taken.

There will be a second-call exam at the end of the course for students who failed the course both in continuous assesment mode and/or first-chance exam. The score of the subject will be the score of this exam. The exam will be scored between 0 and 10. To pass the subject, at least 5 points are needed.

Sources of information

Basic Bibliography

Nasser Kehtarnavaz and Mark Gamadia,, **Real-Time Image and Video Processing: From Research to Reality**, 1, Morgan & Claypool publishers, 2006

Gerassimos Barlas, **Multicore and GPU Programming: An Integrated Approach**, 1, Elsevier, 2015

Complementary Bibliography

Nasser Kehtarnavaz, Shane Parris,Abhishek Sehgal, **Smartphone-Based Real-Time Digital Signal Processing**, 1, Morgan & Claypool publishers, 2015

Nasser Kehtarnavaz, Fatemeh Saki, **Anywhere-Anytime Signals and Systems Laboratory: From MATLAB to Smartphones**, 1, Morgan & Claypool publishers, 2016

Recommendations

Subjects that it is recommended to have taken before

Signal Processing in Audiovisual Systems/V05M145V01205
Signal Processing in Communications/V05M145V01102

Contingency plan

Description

At first try, all activities are preferred to be done in person but can be done remotely if necessary.

GROUP A:
- Group A classes using the virtual campus.

GROUP B:
- Group B activities would focus on student work and tutoring meetings through the virtual campus.

ASSESMENT:
- The submission of group B works is already done remotely (using faitic as document delivery place).
- The problem solving exam can be done online using faitic and remote campus.
- Presentations can be done online through virtual campus.

IDENTIFYING DATA				
Communication Advanced Systems				
Subject	Communication Advanced Systems			
Code	V05M145V01302			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Mosquera Nartallo, Carlos			
Lecturers	Gómez Cuba, Felipe Mosquera Nartallo, Carlos			
E-mail	mosquera@gts.uvigo.es			
Web				
General description	This course covers the application of advanced mathematical tools to address some challenges in new and emerging satellite and terrestrial communication systems, with special emphasis on lower layers and multiuser systems.			

Competencies	
Code	
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CE22	CE22/PS2 Ability to understand the impact of the requirements of the telecommunications systems design services, with special emphasis in the lower layers, while maintaining a global vision of the solutions employed in modern commercial systems of communications.

Learning outcomes	
Learning outcomes	Competences
Understand the impact of telecommunication services requirements on system design, with special emphasis on lower layers.	CG4 CE22
Acquire a global view of the solutions developed for modern commercial communication systems.	CG4 CE22

Contents	
Topic	
1. Convex optimization	1.1 Basic concepts of convex sets 1.2 Introduction to convex functions 1.3 Quasiconvex functions 1.4 Convex optimization problems 1.5 Duality 1.6 Introduction to non-convex problems 1.7 Practical examples in communications
2. Multi-user fundamentals	2.1 Multi-user channels and bounds 2.2 Multiple-access channel: coordinated and uncoordinated access, rate regions, multiuser detection techniques, random access schemes. 2.3 Broadcast channel: rate regions, precoding, non-orthogonal techniques.

Planning			
	Class hours	Hours outside the classroom	Total hours
Seminars	6	15	21
Problem solving	0	25	25
Lecturing	24	53	77
Problem and/or exercise solving	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

Seminars	Different communication systems will be presented with special emphasis on those challenges which are at the core of modern solutions and require advanced mathematical tools. Skills CG4 and CE22 are developed here.
Problem solving	Every week a homework challenge will be proposed to be solved with the aid of mathematical analysis, software tools or both. Skills CG4 and CE22 are developed here.
Lecturing	Advanced mathematical tools will be introduced as background material to address practical solutions in modern communication systems. Skills CG4 and CE22 are developed here.

Personalized assistance

Methodologies	Description
Lecturing	Student support will be provided during office hours and by e-mail.
Seminars	Student support will be provided during office hours and by e-mail.
Problem solving	Student support will be provided during office hours and by e-mail.

Assessment

	Description	Qualification	Evaluated Competencess	
Problem solving	Every week a homework challenge will be proposed to be solved with the aid of mathematical analysis, software tools or both. If the solution is not turned in within the allocated deadline, the corresponding assignment will not be graded.	50	CG4	CE22
Problem and/or exercise solving	Final exam with short questions and exercises.	50	CG4	CE22

Other comments on the Evaluation

The students need to obtain 50 out of 100 points to pass the course. In addition, a minimum grade of 30% is required in the final exam; if this grade is not achieved, the final grade will be that obtained in the final exam. This applies also to the second call.

The grades obtained from the weekly assignments are only valid for the current academic year, and cannot be redone after the corresponding deadline. A student can decide to opt out the evaluation of the weekly assignments; in such a case, his/her final score will be fully based on the final exam. This applies also to the second call. Once the student turns in any of the deliverables, he/she will be considered to be following the continuous evaluation track.

Any student that chooses the continuous evaluation track will get a final score, regardless of her/his taking the final exam.

All the homeworks and exam will be given in English.

Sources of information

Basic Bibliography

Stephen Boyd, Lieven Vandenberghe, **Convex Optimization**, Cambridge University Press, 2004
Carlos Mosquera, **Class notes**, 2020
David Tse, Pramod Viswanath, **Fundamentals of Wireless Communication**, Cambridge University Press, 2005

Complementary Bibliography

Dimitri P. Bertsekas, **Convex Optimization Theory**, Athena Scientific, 2009
David G. Luenberger, Yinyu Ye, **Linear and Nonlinear Programming**, Fourth, Springer, 2016

Recommendations

Subjects that it is recommended to have taken before

Advanced Digital Communications/V05M145V01204
Signal Processing in Communications/V05M145V01102

Other comments

Attendance to physical classes is mandatory. If a minimum 80% attendance is not fulfilled, the grade will be entirely based on the final exam.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies are maintained, along with monitoring and assessment mechanisms.

* The interaction with the students will be performed on-line, with lectures and office hours offered in synchronous mode.

IDENTIFYING DATA				
Statistical Signal Processing				
Subject	Statistical Signal Processing			
Code	V05M145V01303			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	López Valcarce, Roberto			
Lecturers	López Valcarce, Roberto			
E-mail	valcarce@gts.uvigo.es			
Web	http://faitic.uvigo.es			
General description	Statistical Signal Processing, encompassing both estimation and detection theory, can be found at the core of many decision-making and information-extracting systems, including communications, audio and image processing, biomedicine, radar, and big data systems, just to name a few. In this course an introduction to the basics of estimation and detection theory is provided. Since the course is targeted to electrical engineering students, the focus is on the development of practical estimation and detection algorithms amenable to implementation in digital processing systems.			

Competencies	
Code	
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE23	CE23/PS3 Ability to apply methods of statistical processing of signal communications systems and audiovisual.

Learning outcomes	
Learning outcomes	Competences
Ability to apply statistical estimation techniques in communications and multimedia systems	CE23
Ability to apply statistical detection techniques in communications and multimedia systems	CE23
Ability to determine and interpret fundamental limits in estimation and detection problems	CG4 CE23
Ability to evaluate the performance of estimation and detection techniques, by analytical as well as by Monte Carlo simulation methods	CG8 CE23

Contents	
Topic	
Part 1: Parameter Estimation	- The statistical estimation problem. Performance metrics: bias, variance, MSE. Minimum Variance Unbiased Estimator (MVUE). - Fisher Information and Cramer-Rao bound. Slepian-Bangs formula. - Best Linear Unbiased Estimator (BLUE) and Maximum Likelihood Estimator (MLE): definition, properties, and examples.
Part 2: Detection Theory	- Hypothesis tests: types. Performance metrics: false positives and false negatives. ROC curves. - Neyman-Pearson theorem: likelihood ratio. - Detection under the Bayesian philosophy: probability of error, risk, optimum detector. - Examples: deterministic and random signals

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	21	23	44
Practices through ICT	7	0	7
Autonomous problem solving	0	28	28
Simulation	0	25	25
Project	0	21	21
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Lecturing	Presentation of main topics, possibly with audiovisual aids. Skills involved: CG4, CG8
Practices through ICT	Computer-based simulation in the lab of statistical signal processing applications to communications and multimedia, via Monte Carlo methods. Performance analysis. Skills involved: CG8, CE23
Autonomous problem solving	Students will be given a series of short homework assignments throughout the course that they should turn in by the set deadline. Skills involved: CG4, CG8, CE23
Simulation	Computer-based simulation of statistical signal processing applications to communications and multimedia, via Monte Carlo methods. Performance analysis. Skills involved: CG8, CE23

Personalized assistance

Methodologies	Description
Lecturing	Student aid will be provided during office hours by appointment, as well as on-line (email).
Practices through ICT	Student aid will be provided during lab hours and office hours by appointment, as well as on-line (email).

Assessment

	Description	Qualification	Evaluated Competencess	
Autonomous problem solving	Students will be given a series of short homework assignments throughout the course that they should turn in by the set deadline.	40	CG4 CG8	CE23
Project	Development of an individual final project in which students will apply the acquired tools and techniques to a practical problem.	60	CG4 CG8	CE23

Other comments on the Evaluation

Students may choose one of the following two assessment options:

1) Continuous assessment: Final grade will consist of:

- final project (up to 6 points)

- homework assignments (up to 4 points)

A minimum grade of 30% in the final project is required in order to pass the course. Otherwise, the overall grade will directly be that of the final project.

Homework grades from the first call will be kept for the second call, in which the student will be allowed to resubmit the final project. Students assume continuous assessment with the submission of any homework assignment.

2) One-shot assessment: The final grade is the one achieved in the comprehensive test, for both the first and second call.

Sources of information

Basic Bibliography

S. M. Kay, **Fundamentals of Statistical Signal Processing, vol. I: Estimation Theory**, 1, Prentice Hall, 1993

S. M. Kay, **Fundamentals of Statistical Signal Processing, vol. II: Detection Theory**, 1, Prentice Hall, 1998

Complementary Bibliography

L. L. Scharf, **Statistical signal processing: detection, estimation and time series analysis**, 1, Pearson, 1991

T. K. Moon, W. C. Stirling, **Mathematical Methods and Algorithms for Signal Processing**, 1, Pearson, 1999

IEEE, **http://ieeexplore.ieee.org/**,

Recommendations

Subjects that are recommended to be taken simultaneously

Communication Advanced Systems/V05M145V01302

Subjects that it is recommended to have taken before

Advanced Digital Communications/V05M145V01204
Signal Processing in Communications/V05M145V01102

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
All of them
* Teaching methodologies modified
None of them
* Non-attendance mechanisms for student attention (tutoring)
Videoconferencing
* Modifications (if applicable) of the contents
N/A
* Additional bibliography to facilitate self-learning
N/A
* Other modifications
N/A
=== ADAPTATION OF THE TESTS ===
There are no modifications of the assessment mechanisms, or the corresponding weights

IDENTIFYING DATA				
Numerical Optimisation in Telecommunications				
Subject	Numerical Optimisation in Telecommunications			
Code	V05M145V01304			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Mathematical Modelling and Numerical Simulation				
Subject	Mathematical Modelling and Numerical Simulation			
Code	V05M145V01305			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Data Protection Cryptographic Techniques				
Subject	Data Protection Cryptographic Techniques			
Code	V05M145V01306			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Machine Learning				
Subject	Machine Learning			
Code	V05M145V01307			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Administration of Networks and Systems				
Subject	Administration of Networks and Systems			
Code	V05M145V01308			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Web Development Technologies				
Subject	Web Development Technologies			
Code	V05M145V01309			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	López Nores, Martín			
Lecturers	López Nores, Martín			
E-mail	mlnores@det.uvigo.es			
Web	http://faitic.uvigo.es			
General description	Description of the most current techniques applications for the development of Web applications. The course will tech the students to develop multiplatform applications based on the HTML5 foundation.			

Competencies	
Code	
CB1	CB1 Knowledge and understanding needed to provide a basis or opportunity for being original in developing and/or applying ideas, often within a research context.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG12	CG12 Skills for lifelong, self-directed and autonomous learning.
CE35	CE50/OP20 Ability to deploy and manage server software application logic of a web service managers, to design and manage non-relational data bases , and understand the functional division of an existing Web application between the client and the server itself

Learning outcomes	
Learning outcomes	Competences
The students will be able to design, develop and manage the whole infrastructure of a web application. Besides, they will be able to develop the application logic and to create responsive user interfaces using web technologies.	CB1 CB5 CG12 CE35

Contents	
Topic	
The current ecosystem of web development	Introduction to HTML5, CSS3 and Javascript. Architectures of web and mobile applications. Concepts and frameworks of multi-platform development.
Markup with HTML5 and Angular	Structural elements of an application. Semantic markup. Forms. Programming interfaces. Data binding and structural directives.
Presentation with CSS3 and SaaS	The box model. Adaptable design. Selectors. Extensions of the SaaS metalanguage.

Application logic with Javascript and TypeScript	Evolution of scripting languages for the web. CRUD applications and REST interfaces. Objects and arrays in Javascript. Processing of JSON and XML content.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	9	18	27
Problem solving	5	14	19
Project based learning	11	66	77
Essay questions exam	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentation of the main concepts and technologies, predominantly through practical examples of use. It will work mainly the competency CE35.
Problem solving	Practices of the concepts presented in the lectures. It will work the CB5 and CE35 competencies.
Project based learning	Development in group of a practical project, consisting in a functional version of a web service that incorporates the main mechanisms presented in the course. It will work the CB5 and CE35 competencies.

Personalized assistance	
Methodologies	**Description**
Lecturing	During the tutoring hours, the professors will deliver personalised attention, to guide the student in the understanding of the theoretical concepts explained in the lecturing sessions or in the practical ones. In these hours, the professors will also follow up on the work linked to the practical project. In the group tutoring hours, the professors will conduct the debate on the solutions proposed by the members of the working groups, and also check the uniform participation of the members in the final development.
Problem solving	During the tutoring hours, the professors will deliver personalised attention, to guide the student in the understanding of the theoretical concepts explained in the lecturing sessions or in the practical ones. In these hours, the professors will also follow up on the work linked to the practical project. In the group tutoring hours, the professors will conduct the debate on the solutions proposed by the members of the working groups, and also check the uniform participation of the members in the final development.

Assessment					
	Description	Qualification	Evaluated Competencess		
Project based learning	Practical project.	70	CB1 CB5		CE35
Essay questions exam	Final exam.	30	CB5	CG12	CE35

Other comments on the Evaluation

Continuous Assessment:

To opt to continuous assessment, it is necessary to attend 80% of the practical lab sessions and make the corresponding deliveries, and also to make the partial deliveries requested for the group development project.

Each one of the deliveries will evaluated separately. The final practical mark will be the result of averaging the mark obtained in the last delivery of the development project (70%) and the arithmetical average of the previous deliveries (30%). All the marks associated to the work done in group will be shared by all of its members.

The final mark will be the obtained by averaging the practical mark (70%) and the mark obtained in the exam (30%).

One-step Assessment:

The student who prefers one-step assessment must tell the professor before the date of the first partial delivery of the development project. In this case, his/her partial deliveries will not be taken into account for his/her mark, but they will for the marks of the other group members who opt to continuous assessment. The final mark will be calculated by averaging the mark obtained in the final delivery of the project (70%) and that of the final examination (30%).

Second Opportunity:

In the second opportunity, the students have to deliver (individually) a set of modifications to the project developed during the course. In the case of the students of one-step assessment, this delivery will account for 70% of the final mark, and the remaining 30% will correspond to the final exam.

For the students who chose continuous assessment, the practical note will be the maximum between (i) the weighted average of the marks of new delivery (70%) and the marks of the partial deliveries (30%) and (ii) the mark corresponding only to the new delivery.

Sources of information

Basic Bibliography

Mark Pilgrim, **HTML5: Up and Running**, 1ª, O'Reilly, 2010

Wesley Hales, **HTML5 and JavaScript Web Apps**, 1ª, O'Reilly, 2012

Chris Griffith, **Mobile App Development with Ionic, Revised Edition**, 1ª, revisada, O'Reilly, 2017

https://developer.mozilla.org/en/docs/Web, **Web technology for developers**,

Complementary Bibliography

Peter Gasston, **The book of CSS3**, 2ª, No Starch Press, 2014

Recommendations

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF METHODOLOGIES ===
All the teaching methodologies will be kept, although they will be implemented through telematic tools, without modifications of the course contents. The tutoring hours will also take place by videoconference.

=== ADAPTATION OF THE EVALUATION ===
No modifications; all the demonstrations, proofs and code reviews will take place through videoconference.

IDENTIFYING DATA				
Mobile Applications Development				
Subject	Mobile Applications Development			
Code	V05M145V01310			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Costa Montenegro, Enrique			
Lecturers	Costa Montenegro, Enrique Gil Castiñeira, Felipe José López Bravo, Cristina			
E-mail	kike@gti.uvigo.es			
Web	http://faitic.uvigo.es			
General description	The course "Development of Mobile Applications" shows an overview of the ubiquitous panorama, in particular of the mobile applications and of the different operating systems in which they run. Mobile applications market has big growth expectations due to the huge number of active mobile devices around the world (several millions), the deployment of smart cities or the evolution of the Internet to the Internet of Everything (people, processes, data and objects). Along the course, an example mobile application (a game) will be developed, through which the different characteristic and functionalities of the Android platform will be introduced: user interfaces, activities, services, context integration, data sharing and security. Besides, those who join the course have to develop their own project, which should include all the phases of development of a mobile application, from the initial design to the publication in online software shops such as Google Play. The documentation of the course will be available in English. The master sessions, the laboratory practises and the follow-up of the tutored works will be in English, as well.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE33	CE46/OP16 Ability to understand the current development of mobile and ubiquitous services and market developments.
CE34	CE47/OP17 Ability to design, create, integrate sources of context, and working group on the development of a mobile application

Learning outcomes	
Learning outcomes	Competences
Acquire an overview of the ubiquitous panorama, in particular of the mobile applications and of the different operating systems in which they run.	CE33
Learn how to build mobile applications including different elements (interaction with the user, context integration, interconnection with other devices, notifications, ...)	CB2 CB5 CG8 CE34
Work in group to propose, build and defend a mobile application.	CB2 CB5 CG8 CE33 CE34

Contents
Topic

Movile Operating Systems	- Overview of the leading operating systems for mobile devices (Android, IOS, Windows Phone). - Versions. - Market evolution.
Android Operating System	- Android architecture. - Components of an Android application: activities, services, content providers and broadcast receivers. - Applications life cycle.
Mobile applications in the market	- Planning the development of an application. - Publication of applications. - Description of mobile applications available in the market.
Building Android applications	- Android Studio SDK - Android emulator - Activities, actions and intents - Services and notifications - Menus, preferences and dialogs - User interfaces with views - Fragments - Concurrency - Permissions - Data persistence - Context integration: localization, sensors - Interconnection: bluetooth, wifi

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	4	4	8
Laboratory practical	12	36	48
Mentored work	4.5	49.5	54
Presentation	0.5	0.5	1
Objective questions exam	1	1	2
Laboratory practice	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
Lecturing	The professors of the course present the main theoretical contents related to the development of applications for mobile devices. Through this methodology the competency CE33 (CE46/OP16) is developed.
Laboratory practical	Students will complete guided and supervised practices about the basic aspects of Android mobile applications. Through this methodology the competencies CB2, CG8, CE33 (CE46/OP16) and CE34(CE7/OP17) are developed.
Mentored work	In groups, design, development and test of a mobile application. Students and professors will have regular meetings to check the correct evolution of the tutored works. Through this methodology the competencies CB2, CB5, CG8, CE33 (CE46/OP16) and CE34(CE7/OP17) are developed.
Presentation	Presentation and defense of the mobile application that has been developed throughout the course.Through this methodology the competencies CG8, CE33 (CE46/OP16) and CE34(CE7/OP17) are developed.

Personalized assistance

Methodologies	Description
Lecturing	The professors of the course will provide individual attention to the students during the course, solving their doubts and questions. Questions will be answered face-to-face or online (during the master session itself or during the tutoring hours). The tutoring hours will be agreed with the students by appointment. The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Laboratory practical	The professors of the course will provide individual attention to the students during the course, solving their doubts and questions. Questions will be answered face-to-face or online (during the lab session itself or during the tutoring hours). The tutoring hours will be agreed with the students by appointment. The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.

Mentored work	The professors of the course will provide individual attention to the students during the course, solving their doubts and questions. Questions will be answered face-to-face or online (during the supervising session itself or during the tutoring hours). The tutoring hours will be agreed with the students by appointment. The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Presentation	The professors of the course will guide the students during the preparation of the presentation of the results of the guided work, mostly during the last sessions of the supervising sessions or during tutorial sessions.

Assessment

	Description	Qualification	Evaluated Competencess		
Mentored work	Whenever possible, the students will be divided in groups, to design, build and test an application for mobile devices. The result will be evaluated after the delivery, taking into account key aspects such as correction, quality, performance and functionalities of the developed application. Likewise, during the development of the project, professors will make a continuous follow-up of the design and the evolution of the implementation, which may include intermediate assessment tests.	45	CB2 CB5	CG8	CE33 CE34
Presentation	At the end of the course, each group of students has to present and defend in English the developed application for mobile devices. The defence has to include a practical demonstration of the use of the application.	10		CG8	CE33 CE34
Objective questions exam	After each master session, students will make a multiple choice test (in English) to evaluate the understanding of the presented topics.	20			CE33
Laboratory practice	In each practice session students will demonstrate the proper functioning of the developments carried out during the session.	25	CB2	CG8	CE33 CE34

Other comments on the Evaluation

FIRST CALL

Following the guidelines of the degree, two evaluation systems will be offered to students attending this course: continuous evaluation and single evaluation. Before the end of the second week of the course, students must declare if they opt for the continuous evaluation or the single evaluation. Those who opt for the continuous evaluation system may not be listed as "not presented" if they make a delivery or an assessment test after the communication of their decision.

Continuous evaluation system

Those students who opt for continuous evaluation system must:

- Take a set of tests with multiple choice questions. These partial tests will be done at the end of each master session. These tests will account for 20 % of the overall grade of the course.
- Take a set of practical tests in the laboratory. These tests will be performed at the end of each practice session. These tests will account for 25 % of the overall grade of the course.
- Design, build and defend a mobile application (tutored work). This task will account for 55 % of the overall grade of the course. A 10 % is reserved for the presentation and defence of the developed mobile application. Though this task will be developed in groups (whenever possible), professors will make a continuous follow-up of the activities performed by each student of a group. If the performance of a student is not in line with the rest of his/her teammates, his/her expulsion of the group might be considered, or he or she might be assessed individually.

The final grade of the course will be equal to the weighted arithmetic mean of the three indicated tasks. To pass the course the final grade must be greater or equal to five.

Single evaluation system

Those students who opt for the single evaluation system must:

- Take a final test with short answer or multiple choice questions (a 20 % of the overall grade of the course).
- Make and demonstrate the proper functioning of the practices in the laboratory (a 25 % of the overall grade of the course).
- Design, build and defend a mobile application (tutored work), individually or if it is possible in groups (a 55 % of the overall grade of the course, with a 10 % reserved for the presentation and defence of the developed mobile application).
- Deliver a *dossier* that includes all the details about the development of the practices in the laboratory and, especially, about the tutored work.

The final grade of the course will be equal to the weighted arithmetic mean of the three indicated tasks, if the *dossier* is delivered, or zero otherwise. To pass the course the final grade must be greater or equal to five.

SECOND CALL
The course final exam will only be held for students who failed the course in the first call.
The assessment will consist in doing one, two or three of the following tasks, depending on the marks achieved in the equivalent tasks during the first opportunity:

- Make a final test with short answers or multiple choice questions (a 20 % of the overall grade of the course).
- Make and demonstrate the proper functioning of the practices in the laboratory (a 25 % of the overall grade of the course).
- Design, build and defend a mobile application (tutored work), individually or if it is possible in groups (a 55 % of the overall grade of the course, with a 10 % reserved for the presentation and defence of the developed mobile application).
- In addition, those who opt for the final assessment system should deliver a *dossier* that includes all the details about the development of the practices in the laboratory and, especially, about the tutored work.

If the mark of any of the tasks in the first opportunity, equivalent to these, is greater or equal to five, the student can choose between keeping his/her marks of the first opportunity or repeating the assessments again.

OTHER COMMENTS

- The obtained grades are only valid for the current academic year.
- Although the tutored work will be completed (if possible) in groups, the performance of each student in his or her group will be monitored continuously. In the case in which the performance of a member of the group wouldn't be adequate compared with the performance of his or her team mates, he or she could be excluded from the group and/or qualified individually. This criteria will be also apply to the presententaion of the developd application.
- The use of any material during the tests will have to be explicitly authorized.
- In case of detection of plagiarism in any of the tasks/tests done, the final grade will be "failed (0)" and the professors will communicate the incident to the head of the school to take the measures that they consider appropriate.

Sources of information

Basic Bibliography

Joshua J. Drake, **Android hackers's handbook**, 1ª,
Wei-Meng Lee, **Beginning Android 4 Application Develeoment**, 1ª,
Jesús Tomás Gironés, **El gran libro de Android**, 5ª,

Complementary Bibliography

Recommendations

Other comments

It is recommended to have Java programming skills

Contingency plan

Description

Tutoring sessions:
Tutoring sessions may be carried out online: either asynchronously (e-mail, FAITIC forums, etc.) or by videoconference, in this case by appointment.

Elearning platforms/tools
Online tuition will be supported by Campus Remoto and FAITIC. Other supplementary platforms may be used to guarantee the accessibility to teaching content.

Classes and assessment
In the case that the teaching is exclusively non-face-to-face, the classes of the subject and its evaluation will be developed in

a similar way, but using the platforms provided by the University.

IDENTIFYING DATA				
Satellites				
Subject	Satellites			
Code	V05M145V01311			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Aguado Agelet, Fernando Antonio			
Lecturers	Aguado Agelet, Fernando Antonio Pérez Fontán, Fernando			
E-mail	faguado@tsc.uvigo.es			
Web	http://faitic.uvigo.es			
General description	The contents of this course cover the basics of satellite standards, system engineering, the different segments of satellite systems, an introduction to product assurance and assembly, integration and verification procedures as well as an introduction to satellite operations. The course will be entirely conducted in English; the use of Spanish or Galego will be optionally allowed in the last exam.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CG3	CG3 Ability to lead, plan and monitor multidisciplinary teams.
CG7	CG7 Capacity for implementation and management of manufacturing processes of electronic and telecommunications equipment; guaranteeing safety for persons and property, the final quality of the products, and their homologation.
CE18	CE18/RAD1 Capacity of elaborating, strategic planning, direction, coordination and technical and economic management of spatial projects applying spatial systems engineering standards, with knowledge of the processes a satellite operation.

Learning outcomes	
Learning outcomes	Competences
To know and apply ECSS management space project standards.	CE18
To know the basics of the system engineering applied to space projects.	CB2 CG3 CE18
To know the mission life cycle of a space mission.	CB2 CE18
To know the documentation generated in each engineering phase in a space mission	CB2 CG3 CE18
To know and ellaborate the main technical studies and budgets in a space mission.	CG3 CG7 CE18
To know applicable methodologies and standards to product assurance (PA) and Assembly, Integration and Verification (AIV) procedures in a space project.	CB2 CG3 CE18
To know the basics of satellite operation procedures and standards	CE18

Contents	
Topic	
International space project standards	ECSS, NASA, INCOSE.
Space project life cycle	Documentation and reviews.
Segments of a satellite project	- Space Segment. - Ground Segment. - User Segment. - Launchers.
Satellite subsystems	- Communication. - Mechanical & Thermal. - Power. - ADCS. - Propulsion. - On-board computer.

Product Assurance and Assembly, Integration and Verification Procedures in a space project.	- Product Assurance (PA) in space projects. - Assembly, Integration and Verifications (AIV) plans and procedures in space projects.
Introduction to satellite operations	- Telemetry and Telecommand definition. - Operation procedures.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	13	39	52
Mentored work	6	18	24
Seminars	10	20	30
Problem and/or exercise solving	1	18	19

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

Methodologies

	Description
Lecturing	The different aspects of the subject are described, including the possibility of using the flipped learning methodology With this methodology CB2, CG3 and CE18 competencies are covered.
Mentored work	Each student will apply the theoretical knowledge to evaluate the technical feasibility of a small satellite project proposed by the student. With this methodology CB2, CG3 and CE18 competences are covered.
Seminars	Each student will apply the theoretical knowledge to different practical tasks that cover the main part of the contents of the subject with the help of specific software. With this methodology CB2, CG7 and CE18 competences are worked.

Personalized assistance

Methodologies	Description
Lecturing	The students will have the opportunity to attend tutorial hours with the university lecturers in the schedule that will be established and published in the subject web-page. They may also send their queries by email.
Seminars	The students will have the opportunity to attend tutorial hours with the university lecturers in the schedule that will be established and published in the subject web-page. They may also send their queries by email.
Mentored work	The students will have the opportunity to attend tutorial hours with the university lecturers in the schedule that will be established and published in the subject web-page. They may also send their queries by email.

Assessment

	Description	Qualification	Evaluated Competencess		
Mentored work	The students will write 2 intermediate reports and a final report including the results obtained to justify the technical feasibility of the proposed small satellite mission. The evaluation will be based on the students' assistance to the master lessons, his or her participation on the seminars as well ass the presented reports and oral presentations showing the obtained results.	45	CB2	CG3	CE18
Seminars	The students will perform simulations using specific software. The evaluation will be based on the students' assistance to the seminars, his or her participation on the seminars and a final report.	35	CB2		CE18
Problem and/or exercise solving	A final test to complement the evaluation of the contents presented in the master sessions. The test will be individual with time limit.	20			CE18

Other comments on the Evaluation

In case of detection of plagiarism in some of the works or tests, the final qualification of the subject will be "suspended (0)" and the lecturers will communicate to the direction of the School the matter in order to take the measures it deems appropriate.

At the beginning of the term, the student will choose the assessment methodology for the first call: single evaluation or continuous evaluation. The second call will be always assessed by single evaluation.

The teaching language will be English.

Both, documentation and presentations of this subject will be exclusively in English.

English shall be used for writing the reports to evaluate the laboratory practices and the tutored works.

The students can use English, Spanish or Galego to respond the final short answer test.

First call

The subject will be evaluated through one of the following mechanisms:

Single evaluation:

- The exam will include questions, numerical problems and/or development of simulations, related with the contents presented in master sessions, seminars and tutored works. It will be necessary to obtain 5 points over 10 to pass the exam.

***Continuous* evaluation.** The subject will be assessed throughout the entire term:

- **Seminars**: each student will have to perform different tasks with a total weight of 35% of the final mark.

- **Tutored works:** each student will participate in different tutored works proposed during the lecture period. This part will
  be evaluated by written reports as well as oral presentatios. This activity will have a total weight of 45% of the final mark.

- **Short answer test:** This exam will be the final assessment of the continuous evaluation, and it will have a total weight of 25% of the final mark.

Second call: the student will have to take an exam which will include questions and/or numerical problems related with the contents presented in the master sessions, seminars and the tutored works (100% of the final mark). Those students following the continuous evaluation, during the fisrt call, can optionally take this exam for the 65% of the final grade.

All the different grades are only valid for the current course, and will expire after the second call in case someone needs to take the course again.

Sources of information
Basic Bibliography
Course documentation and slides,
James R. Wertz, David F. Everett and Jeffery J. Puschell, **Space Mission Engineering: The New SMAD**, 4,
http://www.ecss.nl,
Complementary Bibliography
http://www.incose.org/,
NASA Systems Engineering Handbook, SP-2007-6105. Rev 1,
Peter Fortescue (Editor), John Stark (Editor), Graham Swinerd (Editor), **Spacecraft Systems Engineering**, 3,

Recommendations

Subjects that it is recommended to have taken before

Analog Electronic Circuits Design/V05M145V01106
Wireless and Mobile Communications/V05M145V01313

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

Synchronous classes at the same time slots than the in-class teaching activities, supported by Campus Remoto and FAITIC. Other supplementary platforms may be used to guarantee the accessibility to teaching content.

* Teaching methodologies modified

In the case of a lockdown, more extensive use of a flipped learning methodology will be used, uploading to faitic support multimedia resources for selected lessons, including recorded video classes, podcast, quizzes as well as weekly activities to be completed by the students.

* Non-attendance mechanisms for student attention (tutoring)

Tutoring sessions may be carried out online: either asynchronously (e-mail, FAITIC forums, etc.) or by videoconference, in this case by appointment

* Modifications (if applicable) of the contents

The contents will be maintained in case of a health alert.

* Additional bibliography to facilitate self-learning

1.- Documentation for the audio opensource software Audacity: https://manual.audacityteam.org
2.- Documentation for the multimedia (video and audio) software OBS: https://obsproject.com/wiki/
3.- Documentation for python: https://www.python.org/doc/
4.- How to install a virtual machine using VirtualBox: https://www.virtualbox.org/wiki/Documentation
5.- GNURadio documentation: https://www.gnuradio.org/docs/

* Other modifications

No further modifications are expected since for the development of the activities for the mentoring work and seminars; the students will be used open-source or licensed software by UVIGO.

=== ADAPTATION OF THE TESTS ===
* Tests already carried out

Since the number of expected students in the subject is reduced, all the assessment will follow the same methodology than in case of in-class teaching activities. Only a final test is scheduled.

Final Test: [Previous Weight 20%] [Proposed Weight 20%]

* Pending tests that are maintained

Final Test: [Previous Weight 20%] [Proposed Weight 20%]

* Tests that are modified

No modifications of the tests are contemplated.

* New tests

No modifications of the tests are contemplated.

* Additional Information

In case of a lockdown, the students will present the results of the project reports (2 intermediate and a final), using a videoconference system.

IDENTIFYING DATA				
Wideband Radio Systems				
Subject	Wideband Radio Systems			
Code	V05M145V01312			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	García Sánchez, Manuel			
Lecturers	García Sánchez, Manuel Santalla del Río, María Verónica			
E-mail	manuel.garciasanchez@uvigo.es			
Web	http://www.faitic.uvigo.es			
General description	Wideband radio systems.			

Competencies	
Code	
CE19	CE19/RAD2 Ability to perform theoretical design, experimental band systems measurement and practical implementation broadband for current applications

Learning outcomes	
Learning outcomes	Competences
Theoretical and experimental knowledge of wideband systems	CE19
Knowledge of designs of wideband active and passive elements	CE19
Fundamentals of wideband signal generation and reception	CE19
Fundamentals of wideband signal measurement	CE19

Contents	
Topic	
Introduction	Definitions and basic concepts Communicaction systems Radio systems. Antennas. Radioelectric spectrum. Modulation. Radio channel. Propagation channel.
Description of the radio channel	Free space Undistorted transmission Attenuation. Multipath Fading. Doppler spread. Delay spread. Frequency selective channels. Precursors.
Mathematical characterization	Narrowband Statistical amplitude distributions Doppler spectrum Wideband Bello formulation
Channel sounders	Narrowband Doppler. Nyquist limit. Wideband. Frequency domain sounders: VNA Time domain sounders. RF pulse. Sliding correlation sounders. Sounder design and performance assesment. Narrowband sounder with spectrum analyzer 0 span. VNA based sounder. Sliding correlation sounder.
Channel sounders lab	Building a wideband sounder to measure the radio channel.

Wideband modulations	Delay spread. Inter symbol interference. Irreducible BER. Frequency hopping: GSM OFDM. Guard interval. Pilot tones. Equalization. PAPR. Amplifiers. DVB-T. 4G. CDMA. Processing gain. Noise. Adquisition and tracking. RAKE receiver. 3G. Power control. Cellular breathing.
UWB systems	1. Definition. Specificities. Regulation 2. Channel characteristics. 3. Impulse radio UWB. 4. Multiband OFDM approach to UWB. 5. Applications
Wideband and UWB antenna design	1. Wideband antennas. Definition and requirements. 2. Characterization of wideband antennas 3. Examples and applications. 4. UWB antennas. Definition and requirements. 5. Characterization of UWB antennas 6. Examples and applications.
UWB applications	Radar Ground penetrating radar Positioning and location Medical imaging Emerging applications

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	2	6	8
Laboratory practical	20	60	80
Flipped Learning	6	18	24
Problem and/or exercise solving	1	5	6
Laboratory practice	1	6	7

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

Methodologies

	Description
Seminars	Activities designed to work on a specific topic , which allow deepen or complement the contents of the subject.
Laboratory practical	Building and testing wideband radio channel sounders
Flipped Learning	Theoretical foundations of wideband systems

Personalized assistance

Methodologies	Description
Laboratory practical	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email.
Flipped Learning	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email.

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	Practice written and oral reports.	40	CE19
Flipped Learning	Exam	60	CE19

Other comments on the Evaluation

First call: We offer the students two schemes of assessment: continuous assessment and final assessment. The students will have to opt by one of the two schemes before a given date.

Second call: just final exam.

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

Sources of information

Basic Bibliography

J.D. Parsons, **The Mobile Radio Propagation Channel**, Wiley,

Complementary Bibliography

H. Schulze, **Theory and applications of OFDM and CDMA**, Wiley,

M. Ghavami L.B Michael R. Kohno, **Ultra Wideband signals and systems in communication engineering**, Wiley, 2007

W. Pam Siriwongpairat K.J. Ray Liu, **Ultra-Wideband Communications systems. Multiband OFDM approach**, Wiley, 2008

W. Wiesbeck, G. Adamiuk, C. Sturm, **Basic Properties and Design Principles of UWB Antennas**, 2009

P. Bello, **Theory and applications of OFDM and CDMA**, 1963

J.D. Parsons, D.A. Demery and A.M.D. Turkmani, **Sounding techniques for wideband mobile radio channels: a review**, 1991

David D. Wentzloff,, **System Design Considerations for Ultra-Wideband Communication**, 2005

Recommendations

Contingency plan

Description

If due to exceptional circumstances the experimental part of the laboratory practices is not carried out, then the learning outcome "Theoretical and experimental knowledge of wideband systems" should be changed to "Theoretical knowledge of wideband systems"

No other changes will be needed under exceptional circumstances

IDENTIFYING DATA				
Wireless and Mobile Communications				
Subject	Wireless and Mobile Communications			
Code	V05M145V01313			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Vazquez Alejos, Ana			
Lecturers	Pérez Fontán, Fernando Vazquez Alejos, Ana			
E-mail	ana.vazquez.alejos@gmail.com			
Web	http://http://faitic.uvigo.es			
General description	This subject introduces the student in the technology of the main present mobile and wireless communication systems, with training in analysis of coverage and quality planning at radio interface level.			

Competencies
Code
CE20CE20/RAD3 Ability to analyse and specify the basic parameters of a mobile or wireless radio network, as well as of quality of service.

Learning outcomes	
Learning outcomes	Competences
Ability to compute the coverage and capacity of a mobile communications site and estimate the cellular radius.	CE20
Dimensioning and capacity planning of mobile and wireless systems.	CE20
Ability to carry out a mobile network deployment planning.	CE20
Ability to select the radio technology most appropriate to a given application.	CE20

Contents	
Topic	
Unit 1. Overview of mobile wireless radio communication systems.	1.1. Introduction to mobile and wireless systems. 1.2. Mobile and wireless radio propagation channel modeling.
Unit 2. Dimensioning and quality of service planning in mobile and wireless radio systems.	2.1. Dimensioning of a mobile radio system. 2.2. Quality of service.
Unit 3. Review of the standards of current cellular systems.	3.1. Introduction to mobile phone systems 1G and 2G. 3.2. 3G mobile phone systems: CDMA, UMTS, 3G. 3.3. 4G mobile phone systems: LTE. 3.4. Next Generation mobile phone systems: 5G and B5G.
Unit 4. Review of the standards of current wireless systems.	4.1. Introduction to wireless systems and services WLAN, sensor networks, vehicular communications, Internet of Things (IoT). 4.2. Design fundamentals: radio propagation channel modeling, dimensioning and quality of service. 4.3. Other wireless systems: DECT, TETRA.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	10	30	40
Case studies	3	3	6
Problem solving	4	6	10
Practices through ICT	5	5	10
Mentored work	10	10	20
Autonomous problem solving	0	10	10
Problem and/or exercise solving	3	3	6
Self-assessment	0	10	10
Essay	0	3	3
Laboratory practice	0	10	10
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentation of the theoretical contents of the subject by teachers.
Case studies	Conducting case studies in laboratory with delivery of a memory/report to be assessed.
Problem solving	Theoretical contents taught in the master lessons will be complemented with the resolution of problems and/or exercises during class time.
Practices through ICT	During the master lessons, practical cases will be realized with delivery of evaluable result at the end of the session.
Mentored work	In group C classes, the development of two works will be proposed that covers any of the subjects considered in master lessons and practices.
Autonomous problem solving	Solving by the student of problems related with the subject applied to specific cases. The student must develop the analysis and resolution of the problems in an autonomous form. These exercises are proposed weekly in attendance hours and they are guided by the professor on the resolution.

Personalized assistance	
Methodologies	**Description**
Lecturing	Time scheduled by professors to attend and resolve doubts of the students.
Autonomous problem solving	Time that the lecturer of group A will use to attend the students that need some support in doing their autonomous work.
Case studies	Time scheduled to help the students in preparing their work.
Problem solving	Time that the lecturer can use to help the students in preparing their work.
Practices through ICT	Time devoted to attend and resolve doubts of the students in the resolution of the proposed practices.
Mentored work	Time devoted to attend and resolve doubts of the students in the realization of the tasks proposed in the C group class.
Tests	**Description**
Problem and/or exercise solving	Time that the lecturer can use to help the students in preparing their tests.
Self-assessment	Time that the lecturer can use to help the students in preparing their tests.
Essay	Time devoted to attend and resolve doubts of the students in preparing the memory of the tutored work.
Laboratory practice	Time devoted to attend and resolve doubts of the students in preparing the memory of the laboratory practices.

Assessment			
	Description	Qualification	Evaluated Competences
Autonomous problem solving	It will evaluate the resolution of problems delivered to each student for troubleshooting in an autonomous form.	10	CE20
Problem and/or exercise solving	Final examination consists of a multiple choice test for assessing the skills acquired by students by solving simple problems and questions of theory. This test includes closed questions with different alternative of answer. Students select an answer from a limited number of possibilities.	35	CE20
Self-assessment	Multiple choice questions tests for each unit of the subject content. The questionnaires are performed through Faitic platform that shows the results after completing each test. Students perform the tests in an autonomous form, and indications are given during attendance and office hours.	10	CE20
Essay	Tutored works performed in group C classes will be evaluated by means of the realization of an individual report by each student.	15	CE20
Laboratory practice	For each lab practice (case studies / analysis of situations) an individual report of results must be presented for assessment.	30	CE20

Other comments on the Evaluation

Students enrolled in the subject can choose one of the two proposed assessment systems: continuous assessment or exam-onlyl assessment. The student must communicate the selected evaluation to the teacher during the first session of type A classes.

Continuous assessment (first call)

Continuous assessment involves performing throughout the semester of the paragraphs disaggregated in the above table.

Each of the blocks is of mandatory fulfillment in the form of continuous and individual assessment, and to pass the subject a minimum of 1/3 of the note assigned to each of the sections and the totall mark accumulated within the five sections to be achieved must overcome at least 50% of the final grade.

The short answer test is multiple choice and is done the day indicated in the official exam schedule. Regarding the block of laboratory practices, one report is required per practice and per student, made in a individual way. Evidences of report copying or cloning will drive to fail the related task.

Continuous assessment involves making 100% of all proposed tasks: active participation in the sessions of classroom and laboratory practices, autonomous work as solving exercises and online/in-class self-assessment tests (questionnaires), C-classes works, as well as performing the final short answer test.

These tasks are not recoverable, that is, if a student does not satisfy the scheduled tasks, the teacher has no obligation to repeat any of them, and also they will be only valid for the academic year in which they are completed.

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

It is considered that the subject is passed if the total grade is equal to or greater than 5. In case of leaving the modality of continuous assessment, the final grade will be "no presentado".

Exam-only assessment (first call)

A student who does not opt for continuous assessment should be eligible for the highest grade by a final exam, which will consist of three parts:

- Part 1: realization of laboratory practices and delivery of reports due (30% of the final grade). One report is required per practice and per student, made in a individual way. Evidences of report copying or cloning will drive to grade as zero the related practice.

- Part 2: test exam (50% of the final grade).

- Part 3: troubleshooting (20% of the final grade).

It is considered that the subject is passed by eventual assessment if the total grade is equal to or greater than 5.

Second call evaluation

For students who followed the continuous assessment, those ones who want to retain the mark obtained in the first part of the continuous assessment (70%) may choose to perform only the test (30%) provided they have exceeded the minimum requirement in each block .

For students who chose the exam-only assessment, the grade will be given by a final exam that will consist of three parts: a practical examination (pass /non-pass) (20%), a standard test exam (40%) and an examination of problems (40%) .

It is considered that the subject is approved in second call if the total grade is equal to or greater than 5.

End-of-program call

It will consist of an exam with three parts: a practical examination (pass /non-pass)(20%), a standard test exam (40%) and an examination of problems (40%). It is considered that the subject is approved if the total grade is equal to or greater than 5.

Ethical code and plagiarism

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

Sources of information
Basic Bibliography
Ana Vazquez Alejos, **Lecture Notes and Powerpoint Slides**, 2017,
Oriol Sallent, **Fundamentos de diseño y gestión de sistemas de comunicaciones móviles celulares**, 2014,
Complementary Bibliography
Jose María Hernando Rábanos, **Comunicaciones Móviles**, 2004,
Mª Teresa Jiménez Moya, Juan Reig Pascual, Lorenzo Rubio Arjona, **Problemas de comunicaciones móviles**, 2006,

José Manuel Huidobro Moya, **Comunicaciones móviles : sistemas GSM, UMTS Y LTE**, 2012,
Martin Sauter, **From GSM to LTE: An Introduction to Mobile Networks and Mobile Broadband**, 2011,
Maciej Stasiak et al., **Modelling and Dimensioning of Mobile Wireless Networks: From GSM to LTE**, 2010,
W. Dargie, C. Poellabauer, **Fundamentals of Wireless Sensor Networks: Theory and Practice**, 2010,

Recommendations

Subjects that continue the syllabus

Antennas/V05M145V01208
Wireless Networks and Ubiquitous Computation/V05M145V01211
Satellites/V05M145V01311
Communication Advanced Systems/V05M145V01302

Subjects that are recommended to be taken simultaneously

Wideband Radio Systems/V05M145V01312

Subjects that it is recommended to have taken before

Radio Laboratory/V05M145V01209
Radiocommunication/V05M145V01103

Contingency plan

Description

In case of online tuition, then the planning will be as follows: classes will be scheduled (group A, B and C) at the same time via the Remote Campus of the University of Vigo. These classes will be broadcast online and recorded to be viewed later in asynchronous mode. The necessary materials will preferably be available on the course platform at Faitic.
In addition, the evaluation will be carried out as follows: problem solving, laboratory practices (software), self-assessment, mentored work and evaluation tests will be arranged in a format for remote resolution by the students, without it being necessary modifying its normal operation.
The test calendar and the weight of the tests in the total evaluation will be maintained.
The tutoring hours will be maintained, but they will take place in the virtual classroom of the teaching staff at the Remote Campus of the University of Vigo. To access, the appropriate indications will be given.
If necessary, tutoring will be enabled through email and videoconference.

IDENTIFYING DATA				
Radio Navigation				
Subject	Radio Navigation			
Code	V05M145V01314			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Optical Networks				
Subject	Optical Networks			
Code	V05M145V01315			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Radar				
Subject	Radar			
Code	V05M145V01316			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Microwave and Millimetre Wave Circuit Design and CAD				
Subject	Microwave and Millimetre Wave Circuit Design and CAD			
Code	V05M145V01317			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Fernández Barciela, Mónica			
Lecturers	Fernández Barciela, Mónica			
E-mail	monica.barciela@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Communications systems are at the mercy of the available technology to fabricate their transceivers. To understand the complexities of modern communications transceivers, their performance requirements and limitations, especially in the microwave and mm-wave frequency bands, it is mandatory to have a closer look to their underlying electronics and fabrication methods. And this look requires not only a theoretical background in active devices and circuit design methodologies or fabrications methods, but most importantly, a practical background in circuit design, fabrication, measurement and performance evaluation. The student has already acquired this theoretical background through previous subjects. The present subject aim to provide the student with some practical background by fully designing, fabricating in hybrid integrated technology and characterizing a circuit prototype, in fact one of the analogue building components of modern transceivers for working in the microwave bands (power amplifier, oscillator or mixer). Most of the presential hours of the course and personal work of the student will be devoted to the design and fabrication of this prototype. Besides this practical work, some presential hours will be devoted to describe the design rules and methodologies of advanced transceiver circuit modules working in microwave and mm-wave bands. Among others, we may mention issues related to the design of efficient power amplifiers or the use of X-parameters to characterize and model these nonlinear components. The subject will be taught fully in english, both in oral and written communications with the students, and in provided technical documents and reports.			

Competencies	
Code	
CG1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE32	CE38/OP8 Ability to design, manufacture (in hybrid technology) and characterize the analog components of transceivers of communications in microwave and millimeter-wave bands

Learning outcomes	
Learning outcomes	Competences
Learn to design analogue advanced active circuits (linear and nonlinear) for emitters and receivers for communications in the microwave and milimeter wave frequency bands.	CG1 CG4 CE32
Learn to design high frequency circuits for the optoelectronic interface in optical communications systems.	CG1 CG4 CE32
Learn the fabrication techniques of integrated circuits (hybrid and monolithic) for communications in the high frequency bands. Learn how to apply one of these techniques in circuit prototype fabrication.	CG1 CG4 CG8 CE32
Learn to characterize and asses the performance of microwave circuits for communication transceivers.	CG1 CE32

Contents

Topic	
1. Advanced circuit design for communication transceivers in the microwave and millimeter wave bands.	a. Linear and Nonlinear Circuit Design Techniques. -CAD-based design and component models. -Measurement-based design. - S-parameters vs X-parameters b. Advanced Low Noise Amplifier Design c. High Eficiency Power Amplifier Design d. High Frequency Oscillator Design e. Frequency Converter Design
2. High frequency circuit design for optoelectronic transceivers in optical communications systems.	Broadband Amplifier Design Techniques
3. Fabrication techniques for Hybrid and Monolithic Microwave Integrated Circuits	Hybrid MIC processing techniques MMIC technologies and foundry processing techniques.
4. Advanced linear and nonlinear characterization techniques, and corresponding instrumentation, to guide design and evaluate performance.	Device linear characterization techniques and instruments: VNAs. Device nonlinear characterization techniques and instruments: NVNAs, VSAs, etc.
5. A Case Study: CAD-based prototype design, fabrication and performance evaluation.	Prototype Design using ADS simulator Prototype fabrication in Hybrid-MIC technology using microstrip transmission lines Prototype characterization to evaluate performance.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	5	10	15
Practices through ICT	14	56	70
Laboratory practical	4	0	4
Mentored work	0	22	22
Mentored work	2	12	14

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

Methodologies

	Description
Lecturing	It will be given in a classroom with the aid of a slate board and a video projector. Main concepts in the relevant Chapters will be described. The student will have available in Faitic support documentation. Note: the last Chapter it is an application work (case study) to be performed by the student, as part of a tutored work. Besides, some of the Topics/sections in the Subject will be individually worked and presented by the students, as part of another tutored work. These lessons are oriented to the acquisition of the competencies: CG1,4,8 and CE38/OP8.
Practices through ICT	During these classes, with the aid of a commercial microwave circuits simulator, the student will design a circuit prototype, among those described in the subject. This work will also continue at home hours through tutorized personal work. The student will have available in Faitic support documentation and files. He/she will be able to obtain a circuit simulator student licence for his/her PC, thanks to an agreement between UVIGO and the simulator provider company. These classes are designed to aid in adquiring competencies: CG1,4,8 and CE38/OP8.
Laboratory practical	The previously designed prototype by the student, during the practices in computer rooms and his/her personal work, will be fabricated in hybrid MIC technology and characterized using adequate instrumentation. These classes are designed to help in adquiring competencies: CG1,4,8 and CE38/OP8.
Mentored work	With the aid of the hours of practice in computer rooms, and through his/her personal work, the student will be guided to fully design - working individually- a circuit prototype. Then, he/her will fabricate this prototype and evaluate its performance during the laboratory practices. The student will write a final report of his/her work. This work with require most of the student effort in the subject. These classes are designed to help in adquiring competencies: CG1,4,8 and CE38/OP8.

Mentored work	Each student will prepare - working individually- a short writen report about one of the topics covered in the subject. This work will also be assesed by an oral presentation in which he/she will answer questions about the work. These classes are designed to help in adquiring competencies: CG1,4,8 y CE38/OP8.

Personalized assistance

Methodologies	Description
Lecturing	The student will be able to consult his doubts, about the different topics described in the master lessons, during the lecturer office hours.
Practices through ICT	During these classes, students -individually- will perform the assigned tasks related to CAD design with the aid and personalized guidance of the lecturer.
Laboratory practical	During these classes, students -individually- will perform the assigned tasks related to prototyping and measurements with the aid and personalized guidance of the lecturer.
Mentored work	The student will be able to consult his doubts and request suggestions in the realization of his work of design/manufacture and measure of the prototype using the lecturer office hours.
Mentored work	The student will be able to consult his doubts and request suggestions in the realization of the work/presentation of a topic, related to the Subject, during the lecturer office hours.

Assessment

	Description	Qualification	Evaluated Competencess	
Mentored work	The student -individually- will design, fabricate in Hybrid Technology and evaluate the performance of a microwave circuit prototype. The assesment will be performed through the circuit design, the quality of the fabricated prototype, the final measured prototype performance and a written report. In this work, it will be evaluated competencies CG1, CG4, CG8 and CE32.	90	CG1 CG4 CG8	CE32
Mentored work	The student -individually, will write a report about a topic related to the subject. The assesment will be performed taking into account the quality of the report and the answers to short questions during the oral presentation of the work. In this work, it will be evaluated competencies CG1, CG4, CG8 and CE32.	10	CG1 CG4 CG8	CE32

Other comments on the Evaluation

The subject will be taught fully in English, both in oral and written communications with the students, and in provided technical documents and reports.

A) First Call: The student work in the subject will be evaluated through the development of the two mentored works:

1. The circuit prototype: design, fabrication in hybrid integrated technology, performance evaluation (simulated and experimental), and written report (90% of the total subject qualification).

2. The written report and its presentation, about a given topic, and his/her answers to the presented questions. (10% of the total subject qualification).

B) Second Call:
Those students who have been present at least in 80% of the presential hours will have the opportunity to re-design his/her previous prototype design and also improve the written report of the topic. Each of these tasks will be assigned the same qualification percentage as in the first call Those students who have not been present in at least 80% of the presential hours, or did not opt for improving their previous works, will have four weeks to design, fabricate, measure, evaluate performance and write a report of a circuit prototype chosen by the lecturer. The assessment of this work will be 100% of the subject qualification.
In the End-of-Program Call, evaluations will be similar to the Second Call.

In case of plagiarism detection in any of the student works, the grade obtained by the student in this course will be a failing grade (0) and the course lecturer/s will communicate this issue to the school Board of Directors so they may take those measures deemed appropriate.

Sources of information

Basic Bibliography

Guillermo Gonzalez, **Microwave Transistor Amplifiers: Analysis and Design**, 2,

Complementary Bibliography

Technical papers (journals, application notes, data sheets,...),

Instrumentation and simulator manuals,

Steve C. Cripps, **Advanced Techniques in RF Power Amplifier Design**, 1,

Guillermo Gonzalez, **Foundations of Oscillator Circuit Design**,
D. Root, **X-Parameters: Characterization, Modeling, and Design of Nonlinear RF and Microwave Components**, 1,

Recommendations

Subjects that it is recommended to have taken before

Electronics and Photonics for Communications/V05M145V01202

Contingency plan

Description

Teaching Group A: Lectures will be online (synchronous or asynchronous).

Teaching Group A: On-line classes (synchronous or asynchronous) will provide the students with descriptions/explanations of the work to be done and aid him to solve his/her doubts, so that, beside the provided supporting documentation and files, as well as the simulator license and online office hours, he/she can performed the assigned work autonomously at home.

The mentored work corresponding to the design of an electronic prototype will not include those parts related to the manufacture and measurement of this prototype. This experimental work will be replaced by the development of an additional report, on another subject topic, or the design of another circuit. The prototype work will correspond in this case to 75% of the subject grade, the extra report/design to 15%.

Evaluation:

First Call:

The mentored works will be evaluated through the delivered written reports, the designs simulations results (prototype or additional circuit) and the oral presentations, which will be performed on-line during the classes of groups B.

Second and End-of-Program Call:

Those students who have been present at least in 80% of the presential hours will have the opportunity to improve their previous deliverables (mentored works). Each of these tasks will be assigned the same qualification percentage as in the First Call.

Otherwise, the student will have 4 weeks to: design, with the aid of the simulator, evaluate performance through simulations and deliver a written report of circuit prototype, suggested by the professor. This work grades up to 80% of the total subject grade. For the remaining 20%, the student will have to deliver a written report on a subject related with one of the subject topics. For performing this report the student will have 1 week.

IDENTIFYING DATA				
Multimedia Security				
Subject	Multimedia Security			
Code	V05M145V01318			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Pérez González, Fernando			
Lecturers	Pérez González, Fernando			
E-mail	fperez@gts.uvigo.es			
Web	http://faitic.uvigo.es			
General description	Multimedia security is an increasingly important topic as most of the information exchanged nowadays over the Internet is multimedia. Traditional data protection solutions like cryptography only solve the problem partially, because contents, once decrypted, are no longer protected. In addition, there is a rising concern over the integrity of multimedia contents: modern editing tools jeopardize our trust on video, images or audio. Fortunately, a number of research groups and companies have addressed these problems and ingenious solutions exist. This course presents advanced topics in multimedia security, with emphasis on cryptography, watermarking, forensics and signal processing in the encrypted domain. Contents, teaching and exams are in English. Students may participate in classes and answer to exams preferably in English, but Spanish and Galician are also accepted.			

Competencies	
Code	
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE31	CE37/OP7 Ability to model, operate, manage, and deal with the full cycle and bagging of networks, services and applications considering the quality of service, direct and costs of operation, the plan of implementation, monitoring, security, scaling and maintenance, managing and ensuring the quality of the development process

Learning outcomes	
Learning outcomes	Competences
Handle the most advanced information protection methods.	CG4 CG8 CE31
Understand the potential and limitations of the different methods.	CG4 CG8 CE31
Handle the use of different algorithms in current multimedia communications environments.	CG4 CG8 CE31
Understand technical material in an autonomous way.	CG4 CG8 CE31

Contents	
Topic	
Introduction to cryptography.	Application to multimedia systems. Integration with source and channel coding. Block and stream ciphers. Hashing and MAC codes. Specific algorithms.
Conditional access systems.	Requirements. History and state of the art. Design of a conditional access system.
Secret sharing.	Simple secret sharing systems. Visual cryptography.

Data hiding and watermarking.	Basic concepts. Watermarking versus data hiding. Spread-spectrum watermarking. Quantization-based watermarking. Application to images and video.
Forensic signal processing.	Quantization detection and estimation. Filtering detection and identification. Resampling detection and estimation. Source ballistics.
Signal Processing in the Encrypted Domain.	Privacy metrics and notions. Homomorphic encryption. Garbled cicruits. Signal representation and cipher blowup. Applications.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	14	28	42
Laboratory practical	9	42	51
Report of practices, practicum and external practices	0	30	30
Essay questions exam	2	0	2

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

Methodologies

	Description
Lecturing	The course is structured in several topics in multimedia security, including cryptography, watermarking, forensics and signal processing in the encrypted domain. Competences: CG4, CG8, CE31
Laboratory practical	Lab practices will cover different aspects of multiple-input data hiding, watermarking and forensics. This will allow students to practically implement and considerably expand some of the concepts seen in the lectures. Competences: CG4, CG8, CE31

Personalized assistance

Methodologies	**Description**
Lecturing	The teachers will provide individualized and personalized attention to students during the course, solving their doubts and questions. Doubts will be answered during the master session, or during the office hours. Office hours will be given at the beginning of the course and published in the subject's webpage.
Tests	**Description**
Report of practices, practicum and external practices	The teachers will provide individualized and personalized attention to students during the course, solving their doubts and questions. Doubts will be answered during the work review sessions or during the office hours.

Assessment

	Description	Qualification	Evaluated Competencess	
Report of practices, practicum and external practices	Reports of the practices and additional personal work that employ the techniques seen in the classroom. Quality of the reports and correctness of the results will be evaluated. Reports will be individual or collective, depending on the size of the unit that carried out the practices.	70	CG4 CG8	CE31
Essay questions exam	Final exam with short questions on the contents of the subject.	30	CG4 CG8	CE31

Other comments on the Evaluation

A minimum score of 30% with respect to the maximum possible score in the final exam is required to pass the course.

In those cases in which the student decides not to carry out the continuous evaluation tasks, the final score will be solely based on the exam with questions of the subject. This applies as well to the second call.

In case the student does not achieve the minimum score in the final written exam, his/her global score will be obtained using the formula: 0.35*REP+0.15*TEST, where REP is the score achieved in the reports and TEST is the score achieved in the final exam.

In case of collective reports, the respective contribution of each student must be clearly stated, and the final score will be personalized as a function of such contribution. An interview with the lecturer may be required in order to assess the individual contributions.

Once the student turns in any of the deliverables, he/she will be considered to be following the continuous evaluation track. Any student that chooses the continuous evaluation track will get a final score, regardless of he/she takes the final exam.

Continuous evaluation tasks cannot be redone after their corresponding deadlines, and are only valid for the current year.

In the case that plagiarism is detected in any of the reports/exams done/taken, the final score for the subject will be 'fail' (0) and the teachers will inform the School authorities of the affaire so that they take the appropriate measures. Besides, the teachers will inform the School authorities of any conduct against ethics by the students, the possibility existing that the School authorities take the appropriate measures.

Sources of information

Basic Bibliography

A.J. Menezes, **Handbook of Applied Cryptography**, 1996,

Complementary Bibliography

Cox, Miller, Bloom, Fridrich, Kalker, **Digital Watermarking and Steganography**, 2nd,

Troncoso-Pastoriza, Perez-Gonzalez, **Secure Signal Processing in the Cloud: enabling technologies for privacy-preserving multimedia cloud processing**, Signal Processing Magazine,

A. Piva, **An Overview of Image Forensics**, Signal Processing,

Recommendations

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
In such case, teaching and evaluation will take place fully or partially online.

IDENTIFYING DATA				
Intelligent Sensors				
Subject	Intelligent Sensors			
Code	V05M145V01319			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Mariño Espiñeira, Perfecto			
Lecturers	Machado Domínguez, Fernando Mariño Espiñeira, Perfecto			
E-mail	pmarino@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The overall objective of this course is to provide the theoretical and practical skills for the design and characterization of the electronic instrumentation systems based on smart sensors in wired or wireless topologies. To achieve this, the main intelligent sensors structures, the sensor networks architectures and topologies, the energy harvesting smart sensors systems and the software tools and hardware platforms for designing smart multi-sensor systems will be studied.			

Competencies	
Code	
CB4	CB4 Students must communicate their conclusions, and the knowledge and reasons stating them-, to specialists and non-specialists in a clear and unambiguous way.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE36	CE43/OP13 Ability to characterize intelligent sensors and their specific characteristics in networks

Learning outcomes	
Learning outcomes	Competences
Know the different structures of the intelligent sensors.	CB5 CG8 CE36
Know the topologies and architectures of the sensor networks.	CB5 CG8 CE36
Know analyse and design systems of efficient sensors in consumption.	CB4 CG8 CE36
Know software tools and hardware platforms for the design of sensor systems.	CB5 CG8 CE36
Design applications based on data fusion of different sensors.	CB4 CG8 CE36

Contents	
Topic	
Unit 1: Smart Sensors.	Definition. Classification. Architectures. Multisensorial systems. Standard IEEE 1451 for smart sensors. Applications: Internet of Things, Industry 4.0, Machine Learning.
Unit 2: Wired topologies.	General features. Classification. Practical examples: PROFIBUS and CAN. Intelligent Transportation Systems (ITS). Embedded buses for automotive applications: LIN, MOST, FLEXRAY, JSAE 1939 and others. Development tools.
Unit 3: Wireless topologies.	The ISM bands. Basic features of wireless networks. Multiplexing and modulation. The SDR concept. Standards for WLAN and WPAN. IEEE standards 802.15.1/4/3. Wireless sensor networks (WSNs). Other commercial networks.
Laboratory	

Unit 1. Wired smart sensors systems.	Analysis and test of smart sensors.
Unit 2. Wireless smart sensors systems.	Design, implementation and test of a wireless sensor network.
Unit 3. Project: Design and implementation of an electronic instrumentation system with smart sensors.	Design, implementation and test of an electronic instrumentation system with smart sensors, applying theoretical and practical concepts.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	4	4	8
Mentored work	1	18.5	19.5
Laboratory practical	7.5	15	22.5
Project based learning	12.5	62.5	75

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

Methodologies

	Description
Lecturing	The lecturer will explain in the classroom the main contents of the subject. The students have to manage the proposed bibliography to carry out a self-study process in a way that leads to acquire the knowledge and the skills related to the subject. The lecturer will answer the students questions in the classroom or at the office. In these sessions, the skills CB4, CB5, CG8, and CE43 will be developed.
Mentored work	The students have to manage basic concepts to search and select information in order to get a deeper understanding in some specific fields related to the subject. The lecturer will propose in the classroom the topic of this individual task and monitor the students work in personalized attention sessions. In these sessions, the skills CB4, CB5, CG8 and CE43 will be developed.
Laboratory practical	Activities designed to apply the main concepts and definitions of the subject. The student will be asked to acquire the basic skills to manage the laboratory instrumentation, software tools and components in order to construct and test electronic circuits. The student has to develop and demonstrate autonomous learning and collaborative skills. He/she is supposed to be able to manage bibliography and recently acquired knowledge. Possible questions can be answered in the laboratory sessions or at the lecturers office. In these sessions, the skills CB4, CB5, CG8, and CE43 will be developed.
Project based learning	Students have to develop a group activity that goes on over a period of time and address a specific problem. They have to design, schedule and carry out a set of tasks to achieve a solution. The assessment will be based on the quality of the proposed solution, the depth of content understanding demonstrated and the final presentation. In these sessions, the skills CB4, CB5, CG8, and CE43 will be developed.

Personalized assistance

Methodologies	Description
Lecturing	The students can go to the lecturers office (individually or in a group). The timetable will be available on the school website at the beginning of the term. Tutoring sessions also may be carried out online: either asynchronously (e-mail, FAITIC forums, etc.) or by videoconference, in this case by appointment. In these sessions the lecturer will answer the students questions and also give instructions to guide the studying and learning process.
Laboratory practical	The students can go to the lecturers office (individually or in a group). The timetable will be available on the school website at the beginning of the term. Tutoring sessions also may be carried out online: either asynchronously (e-mail, FAITIC forums, etc.) or by videoconference, in this case by appointment. In these sessions the lecturer will help students understand the work to be developed in the laboratory (components, circuits, instrumentation and tools).
Mentored work	The students can go to the lecturers office (individually or in a group). The timetable will be available on the school website at the beginning of the term. Tutoring sessions also may be carried out online: either asynchronously (e-mail, FAITIC forums, etc.) or by videoconference, in this case by appointment. In these sessions the lecturer will help students to deal with the monitored work.
Project based learning	The students can go to the lecturers office (individually or in a group). The timetable will be available on the school website at the beginning of the term. Tutoring sessions also may be carried out online: either asynchronously (e-mail, FAITIC forums, etc.) or by videoconference, in this case by appointment. The lecturers will be available to help students in order to deal with the project as well as the monitored work.

Assessment

Description	Qualification	Evaluated Competencess

Mentored work	The lecturers will consider the quality of the results obtained, their analysis, the final report, and the classroom presentation. The tutored work mark (TWM) will be assessed in a 10 points scale. In these works, the skills CB4, CB5, CG8 and CE43 will be evaluated.	20	CB4 CB5	CG8	CE36
Laboratory practical	The lecturers will check the level of compliance of the students with the goals related to the laboratory skills. The final mark of laboratory (FML) will be assessed in a 10 points scale. For the evaluation of the laboratory sessions, the lecturer will assess the group work (the same mark for each member), as long as it was possible to form groups, the individual preliminary tasks and the answers to personalized questions for each session. In these practices, the skills CB4, CB5, CG8 and CE43 will be assessed.	20	CB4 CB5	CG8	CE36
Project based learning	The lecturers will consider the quality of the results obtained, their presentation and analysis, and the final oral presentation. The final mark of the project (FMP) will be assessed in a 10 points scale. For the evaluation of the project, the lecturer will assess the group work (the same mark for each member), as long as it was possible to form groups, and the individual oral presentation of the developed project. The skills CB4, CB5, CG8 and CE43 will be evaluated in these projects.	60	CB4 CB5	CG8	CE36

Other comments on the Evaluation

1. Continuous evaluation (first call)

According to the guidelines of the master and the agreements of the academic commission, a continuous assessment learning scheme will be offered to the students.

In order to ***be assessed by continuous evaluation,*** the student cannot miss more than one theory session, more than one laboratory session and more than one project session; and only if this absence is duly justified.

The subject comprises three different parts: theory (20%), laboratory (20%) and project (60%). Once a task has been assessed, the students can not do/repeat the task at a later date. The marks are valid only for the current academic course.

1.a Theory

Attendance at the theory classes is compulsory. In order to pass the theory part, the student cannot miss more than one theory session and only if this absence is duly justified.

In the first weeks of the course each student will be asked to carry out a task individually with the help of the lecturer about a topic related to the subject. In order to assess the work, the lecturer will consider the results, their analysis and presentation, and the quality of the written report. The students will be informed of the deadline by the lecturer. The tutored work mark (TWM) will be assessed in a 10 points scale. If the students present their works after the deadline the TWM will be 0.

The final mark of theory (FMT) will be: FMT = TWM.

The minimum mark required to pass this part is of 5 (FMT>=5).

1.b Laboratory

Three laboratory sessions are scheduled. Each session lasts approximately 150 minutes and the students will work in pairs (whenever possible). This part also will be assessed by continuous assessment. Each session will be only evaluated according to the developed work at the schedule date. The lecturer will consider the work of the students carried out before the laboratory session to prepare the proposed tasks, the work in the laboratory to deal with them as well as the student□s behavior.

Marks for each laboratory session (LSM) will be assessed in a 10 points scale. A mark of 0 will be obtained for missing sessions. In order to pass the laboratory part the students can not miss more than one laboratory sessions and only if this absence is duly justified. The final mark of laboratory (FML) is calculated as the arithmetic mean of the individual laboratory session marks:

FML = (LSM1 + LSM2 + LSM3)/3

1.c Project

In the first session lecturer will present the objectives and the schedule of the project. They also assign a specific project to each group (two students per project whenever possible). After that, the most important part of the workload will be

developed in the laboratory: one laboratory session (B hours) and the project sessions (C hours).

In order to assess the project, the lecturer will consider the results, their analysis and presentation, and the final oral presentation. The final mark of project (FMP) will be assessed in a 10 points scale. The minimum mark required to pass this part is of 5 (FMP>=5). The students are only allowed to miss one project session and only if this absence is duly justified.

1.d Final mark of the subject

The weighted points from all assessed parts are added together to calculate the final mark (FM). The following weightings will be applied: 20% theory (FMT), 20% laboratory (FML) and 60% project (FMP).

In order to pass the subject, students will be required to pass the theory, laboratory and project parts. In this case the final mark (FM) will be:

$$FM = 0.2 \cdot FMT + 0.2 \cdot FML + 0.6\ FMP.$$

However, when the students do not pass both parts (FML < 5 or FMP < 5), or miss more than 1 theory session, or more than 1 laboratory session, or miss more than 1 project session, the final mark will be:

$$FM = \min\{4\ ;\ (0.2 \cdot FMT + 0.2 \cdot FML + 0.6\ FMP)\}.$$

A final mark higher than five points (FM >= 5) should be achieved in order to pass the subject.

2. Single evaluation (first call)

The students who prefer a different educational policy can attend an exam on a scheduled date. The date will be specified in the academic calendar. This exam will comprise three parts: theory exam, laboratory exam and project. The student will prepare a written project report to be handed in just before the exam. The final project must be presented within one week of delivery of reports. In order to assign the project, the student has to contact to the lecturer at least four weeks before the exam.

In order to pass the theory, the student will have to attend to an exam with test questions and/or sort answer questions. The theory exam will be assessed in a 10 points scale and and the final mark of theory (FMT) will be the obtained mark.

In the laboratory exam the student will be asked to deal with some of the electronic circuits developed in the laboratory sessions as well as some short answer questions related to these sessions. The laboratory exam will be assessed in a 10 points scale and the final mark of laboratory (FML) will be the obtained mark.

In order to assess the project, the lecturer will consider the results, their analysis and presentation, and the quality of the written report. The project will be assessed in a 10 points scale and the the final mark of project (FMP) will be the obtained mark.

In order to pass the subject, students will be required to pass each part (FMT>=5, FML>=5 and FMP>=5). In this case the final mark (FM) will be:

$$FM = 0.2 \cdot FMT + 0.2 \cdot FML + 0.6\ FMP.$$

However, when the students do not pass all parts (FMT < 5 or FML < 5 orFMP < 5), the final mark will be:

$$FM = \min\{4\ ;\ (0.2 \cdot FMT + 0.2 \cdot FML + 0.6\ FMP)\}.$$

A final mark higher than five points (FM >= 5) should be achieved in order to pass the subject.

3. Second call evaluation

The assessment policy in this call will follow the scheme described in the previous section. Dates will be specified in the academic calendar. This exam consist on a theory exam, a laboratory exam and a project. The student will prepare a written project report to be handed in just before the exam. The final project must be presented within one week of delivery of reports. In order to assign the project, the student has to contact to the lecturer at least four weeks before the exam.

The marks obtained in the previous continuous or single evaluation are kept for those parts in which the student has not

attended. The final mark will be calculated as it has described in:

- section 1 to students with the theory part passed in continuous evaluation.
- section 2 for all other case.

Sources of information

Basic Bibliography

Fraden, J., **Handbook of modern sensors**, 5th, Springer, 2016

Gómez, C., Paradells, J. y Caballero, J.E., **Sensors Everywhere: Wireless Network Technologies and Solutions**, Fundación Vodafone España, 2010

Misra, S., Woungang, I. & Chandra, S., **Guide to Wireless sensor networks**, Springer, 2009

Slama, D., Puhlmann, F., Morrish, J. and Bhatnagar R.M, **Enterprise IoT: Strategies and Best Practices for Connected Products and Services**, O'Reilly, 2016

Rogers, L. a& Stanford-Clark, A, **Wiring the IoT: Connecting Hardware with Raspberry Pi, Node-Red, and MQTT**, O'Reilly, 2017

Complementary Bibliography

Mariño-Espiñeira, P., **Las comunicaciones en la empresa; normas, redes y servicios**, 2ª, RAMA, 2006

Faludi, R., **Building wireless sensor networks.**, O´Reilly, 2011

Parallax Inc., **Smart Sensors and Applications**, 3rd, Parallax Inc., 2006

Recommendations

Contingency plan

Description

In case of online tuition, then the planning and the evaluation will be carried out as follows:

* Theory: the theory classes will be performed through electronic means and the contents will be available online.

* Practices: depending on the contents developed in each laboratory practice and the availability of material, the session will be performed in a virtual way, in the students home (using provided basic equipment) or by simulation (using free software or University licensed software). The details of each practices session will be available online in FAITIC. In this scenario, the practices will be individually developed and evaluated.

* Project: depending on the proposed project and the availability of material, the work will be performed in a virtual way, in the students home (using provided basic equipment) or by simulation (using free software or University licensed software). The details of each project session will be available online in FAITIC. In this scenario, the project will be individually developed and evaluated.

* Assessment: the assessment will supported by FAITIC and Campus Remoto.

IDENTIFYING DATA				
Practicals in Digital Electronics for Communications				
Subject	Practicals in Digital Electronics for Communications			
Code	V05M145V01320			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Distributed Computing				
Subject	Distributed Computing			
Code	V05M145V01321			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Mikic Fonte, Fernando Ariel			
Lecturers	Burguillo Rial, Juan Carlos Mikic Fonte, Fernando Ariel Rodríguez Hernández, Pedro Salvador			
E-mail	mikic@gist.uvigo.es			
Web	http://faitic.uvigo.es			
General description	This course will provide a vision of group of the most usual technologies inside the distributed computing. They will tackle subjects such as the distributed transactions and the replication; the grid computing, cloud computing, and cluster computing; the distributed artificial intelligence; and the parallel and evolutionary computing. We will use Spanish and Galician languages in classroom, and English language for the instructional materials.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CB4	CB4 Students must communicate their conclusions, and the knowledge and reasons stating them-, to specialists and non-specialists in a clear and unambiguous way.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE24	CE24/TE1 Ability to understand the fundamentals of distributed systems and distributed computing paradigms, and its application in the design, development and management in grid, ubiquitous computing scenarios and cloud systems.

Learning outcomes	
Learning outcomes	Competences
To earn skills in the design, development and management of distributed systems.	CB2 CG8 CE24
To undertand the functional bases of the distributed systems.	CB4 CB5 CE24
To know the distinct concepts related with the distributed computing: clustering, grids, cloud computing and ubiquitous computing.	CB5 CG8 CE24
To earn skills for the application of intelligent systems in the distributed computing.	CB2 CB5 CG8 CE24
To learn how to distribute the execution of tasks for the resolution of problems and optimisation by means of evolutionary and parallel computing.	CB2 CB4 CG8 CE24

Contents	
Topic	
1. Distributed artificial intelligence	1. Intelligent agents and multiagent systems 2. Theory of games applied to multiagent systems: coordination, competition, negotiation, auctions, electronic trade 3. Complex distributed systems and auto-organised ones

2. Parallel and evolutionary computation	1. Distributed Computing and parallelization 2. Algorithms and evolutionary programming: genetics, memetics, differential evolution, intelligence of swarm. 3. Optimisation by means of evolutionary technics and parallelization
3. Transactions	1. Concurrency problems 2. Recoverability problems 3. Deadlocks 4. Optimistic concurrency control 5. Timestamps
4. Replication	1. Introduction to replication 2. Case studies of high available services (Bayou and Coda) 3. Transactions with replicated data 4. Design of distributed systems: Google case study
5. Grid and Cluster	1. Basic concepts of grid computing 2. Basic concepts of cluster computing.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	17	0	17
Practices through ICT	9	0	9
Autonomous problem solving	0	92	92
Problem and/or exercise solving	3	0	3
Report of practices, practicum and external practices	0	3	3
Laboratory practice	1	0	1

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

Methodologies

	Description
Lecturing	Theoretical classes with practical cases. Besides, problems will be proposed for solving them in autonomous way. Competencies related to this activity: CB5 and CE24
Practices through ICT	Practices by means of computers connected in network and/or virtual machines. Competencies related to this activity: CB2, CB4, and CG8
Autonomous problem solving	Study work on the contents of theoretical classes, as well as support for the achievement of practices through ICT. Competencies related to this activity: CB5 and CG8

Personalized assistance

Methodologies	Description
Practices through ICT	The personalised attention will carry out in the practical part of the course, as in the tutorial time. The tutorials may be carried out by telematic means (email, videoconference, FAITIC forums, etc.) and an appointment may be required.

Assessment

	Description	Qualification	Evaluated Competencess		
Problem and/or exercise solving	Examinations composed by a series of short answer questions and/or test type ones that the student will have to answer in the classroom individually.	60	CB2 CB4 CB5	CG8	CE24
Report of practices, practicum and external practices	Detailed report of the tasks during the practices of laboratory carried out in group.	5	CB2 CB4	CG8	CE24
Laboratory practice	Assessment of the work carried out by the students during the laboratory practices carried out in group. Level of involvement, participation in the practices, and performance of the work	35	CB2 CB4 CB5	CG8	CE24

Other comments on the Evaluation

Students can, at first call, decide to be assessed according to a continuous assessment model or by an exam-only assessment. The fact of presenting to the first continuous assessment exam involves opting for this assessment model

(otherwise opting for the exam-only asessment model). Once the students choose the continuous assessment model, their grade can never be "Not Submitted". For second call the students will be evaluated using the modality of "exam-only assessment" (some modifications over the original practices can be required). The scores obtained in first call are not preserved for second call.

Plagiarism and copy are not allowed.

1- CONTINUOUS ASSESSMENT

To pass the course requires a minimum score of 5 points. The score will be the result to add the scores received in each one of the following parts:

- Exam 1:
    - Dates: Before the middle of the semester
    - Individually
    - Contents: Theoretical content given until this moment
    - Type: Series of short answer questions and/or test type ones
    - Maximum score = 2 points
- Exam 2:
    - Dates: Official calendar (coinciding with the exam-only assessment for those that opted by this modality)
    - Individually
    - Contents: Theoretical content given until this moment excepting those that already were assessed in the Exam 1.
    - Type: Series of short answer questions and/or test type ones
    - Maximum score = 4 points
- Practices:
    - Dates: Since week 3 to week 11
    - In group:
        - Reports / memories of practice and Laboratory practice: A personalized score is asigned to each member of the group according to the following:
        - Final score of practices = (Memory + Practice) * Weighting factor
            - Memory maximum score = 0.5 points
            - Practice maximum score = 3.5 points (verification of the correct operation of the practice and of possible changes to be made in it, in group or individually).
            - Weighting factor = (Follow-up by the teacher + Peers assessment) / 20
                - Follow-up by the teacher: About the work carried out by each student observed by the teacher (0-10)
                - Peers assessment: Within each group. Each student asseses his/her partners about the work they did (0-10). Then, an arithmetic average is calculated for each student.
    - Maximum score= 4 points

2- EXAM-ONLY ASSESSMENT

To pass the course requires a minimum score of 5 points.

- Theoretical exam:
    - Dates: Official calendar
    - Individually
    - Contents: Given in the whole theoretical part of the course.
    - Type: Series of short answer questions and/or test type ones
    - Maximum score= 6 points

- Practice exam and delivery of practice:
    - Dates of the exam: Official calendar
    - Dates of the delivery of practice: Before the exam.
    - Individually.
    - Contents: Related to the practice and its performance.
    - Type: Series of short answer questions and/or test type ones, and verification of the correct operation of the practice and of possible changes to be made in it.
    - Maximum score= 4 points

Sources of information

Basic Bibliography

George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, **Distributed systems. Concepts and design**, 5, Addison Wesley, 2011

Michael Wooldridge, **An Introduction to Multiagent Systems**, 2, Addison-Wesley, 2009

A.E. Eiben, J.E. Smith, **Introduction to Evolutionary Computing (Natural Computing Series)**, 2, Springer, 2015

Tom White, **Hadoop: The Definitive Guide**, 3, O'Reilly Media, 2012

Complementary Bibliography

Thomas Rauber, Gudula Rúnger, **Parallel Programming for Multicore and Cluster Systems**, 2, Springer, 2013

Recommendations

Subjects that it is recommended to have taken before

Application Technologies/V05M145V01105

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION ===
Those methodologies used and tests to be carried out in person will respectively be used and carried out online through the Remote Campus and the Faitic platform (without prejudice to other measures that can be adopted to guarantee the accessibility of the students).

IDENTIFYING DATA				
Data analysis				
Subject	Data analysis			
Code	V05M145V01322			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	González Castaño, Francisco Javier			
Lecturers	González Castaño, Francisco Javier			
E-mail	javier@det.uvigo.es			
Web	http://http://faitic.uvigo.es			
General description	Data analysis with a practical approach: data extraction and cleansing, data characterization with techniques such as statistical regression, clustering or outlier analysis, and knowledge generation with techniques such as intuitive visualization or automatic classification. The course is taught in Spanish.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CB3	CB3 Students must integrate knowledge and handle complexity of formulating judgments based on information that was incomplete or limited, including reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE25	CE25/TE2 Ability to manage the acquisition, structuring, analysis and visualization of data, extracting information and underlying knowledge, critically assessing the results, and applying it to strategic decision-making and innovation in different areas.

Learning outcomes	
Learning outcomes	Competences
- Knowledge of the different stages of knowledge extraction and the areas of application of data mining.	CB2 CB3 CG4 CG8 CE25
- Knowledge of the importance of the preparation of the data and how to apply the main pre-processing techniques.	CB2 CG4 CG8 CE25
- Knowledge of the main techniques of data mining as well as the necessary premises for its application to a particular stage.	CB2 CB3 CG4 CG8
- Knowldge of the different types of data mining results evaluation and how to apply them.	CE25
- Knowledge of statistical software and how to apply it to on-line and off-line data mining.	CG4 CE25
-Ability to to schedule, develop and evaluate a data analysis process.	CG4 CG8 CE25
New	

Contents	
Topic	
Statistical analysis of data	- Correlation and causation. - Regressions. - Intervals of confidence and error. Hypothesis tests.
Data mining	- Cleaning, integration, reduction and transformation of data. - Classification and clustering.

Computational analysis of data	- Large-scale data analysis. - Visualisation of data and results. - Application scenarios.

Planning			
	Class hours	Hours outside the classroom	Total hours
Project based learning	2	36	38
Laboratory practical	5	19	24
Lecturing	20	40	60
Problem and/or exercise solving	2	0	2
Essay	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Project based learning	Arranged in groups, the students will solve a practical case of data analysis in an application scenario. CB2 CB3 CG4 CG8 CE25
Laboratory practical	During the course, students will develop solutions in laboratory sessions to grasp the course content. CB2 CB3 CG4 CG8 CE25
Lecturing	Lectures that will illustrate the course content with small exercises. These will be solved by the lecturer of the students themselves, alone or in groups. The goal is to foster discussion and knowledge of course competencies. CB2 CB3 CG4 CG8.

Personalized assistance	
Methodologies	**Description**
Lecturing	Individual atention will take place during official tutoring times or via e-mail at any time.
Project based learning	Individual atention will take place during official tutoring times or via e-mail at any time.
Laboratory practical	Individual atention will take place during official tutoring times or via e-mail at any time.

Assessment					
	Description	Qualification			Evaluated Competencess
Problem and/or exercise solving	Short-answer written exam.	40			CE25
Essay	Each student will present two deliverables reporting his/her work on a dataset that will be handed at the beginning on the course.	60	CB2 CB3	CG4 CG8	CE25

Other comments on the Evaluation

FIRST CALL

At the beginning of the course the student will have to choose between continuous and single evaluation. No change of decision will be allowed.

Continuous evaluation will consist in the following::

1. Short answer test (4 points maximum).
2. Two deliverables of the work on a common dataset (6 points maximum)

To pass the course, the student must obtain 1,5/4 points at least in the short answer test and an overal score (across all possible activities) above 5 points. Failure to reach the minimum grade in the short answer test limits the maximum achievable grade to 4. The maximum score is 10 points.

The contents of the short answer test and the deliverables will be balanced for a reasonable preparation effort.

Single evaluation will consist on a single exam covering the whole theoretical and practical course content (the maximum score of this exam will be 5 points. A minimum score of 2 is necessary to pass the course) and a deliverable based on a dataset selected by the professor (maximum score of 5 points). The minimum score to pass the course is 5 points overall. Failure to reach the minimum grade in the exam limits the maximum achievable grade to 4. The maximum score is 10 points.

SECOND CALL

The only possibility will be single evaluation, as previously described.

Sources of information

Basic Bibliography

Complementary Bibliography

Zummel, N., Mount, J., **Practical Data Science with R**, ISBN 9781617291562, Manning Publications,

James, G., Witten, D., Hastie, T., Tibshirani, R., **An Introduction to Statistical Learning with Applications in R**, ISBN 9781461471387, Springer,

Recommendations

Contingency plan

Description

In case of exceptional circumstances related to COVID 19 there will be no written exam. Assessment will be totally based on the two assignments.

IDENTIFYING DATA				
Economical and Social Networks				
Subject	Economical and Social Networks			
Code	V05M145V01323			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Sousa Vieira, Estrella			
Lecturers	Sousa Vieira, Estrella			
E-mail	estela@det.uvigo.es			
Web	http://faitic.uvigo.es			
General description	Social and Economic networks tackles the dynamic and structural study of networks of relationship between agents that arise in the fields of telecommunications, economy and sociology. We study, in particular, dynamic models of diffusion of information, of contagion, of strategic balance and of training of coalitions. The theoretical contents are applied to a practical study case.			

Competencies	
Code	
CB1	CB1 Knowledge and understanding needed to provide a basis or opportunity for being original in developing and/or applying ideas, often within a research context.
CB3	CB3 Students must integrate knowledge and handle complexity of formulating judgments based on information that was incomplete or limited, including reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE26	CE26/TE3 Ability to understand and know to exploit the processes of training and dissemination of information in social networks, applying them to the improvement of Internet
CE27	CE27/TE4 Ability to design and manage distributed systems based on learning and incentive

Learning outcomes	
Learning outcomes	Competences
Understand the static and dynamic phenomena that explain the structure of the social networks	CG4 CE26
Know how to analyse the mechanisms of training of networks in strategic terms	CG4 CG8 CE26 CE27
Know how to model and apply to real data the processes of diffusion of information in social networks	CB1 CB3 CE26 CE27
Know how apply the procedures of structural and dynamic analysis of the networks to analyse complex systems in the technological fields, biological, economic and social.	CB1 CB3 CG4 CG8 CE26 CE27
Know how to use the dynamics of learning in networks to characterise phenomena	CB1 CB3 CG4 CE27

Contents	
Topic	
1. Basic models	a. Empirical evidence b. Descriptive parameters, centrality and importance c. Scaling laws

2. Training of networks	a. Random models: static training b. Random models: dynamic training c. Strategic training: stability, efficiency and incentives
3. Diffusion and learning in social networks	a. Simple diffusion SIR, SIS and others b. Learning and reinforcement in networks c. Games in networks: strategic complements and strategic substitutes
4. Applications	a. Meritocracy. Identification of experts and leaders b. Trending topics c. Recommendations/punctuations d. Virality e. Origins of rumours

Planning

	Class hours	Hours outside the classroom	Total hours
Project based learning	6	36	42
Autonomous problem solving	4.5	21	25.5
Lecturing	18.5	36	54.5
Essay questions exam	2	0	2
Objective questions exam	1	0	1

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

Methodologies

	Description
Project based learning	Development of a practical project of analysis and modeling of a technological, social, biological or economic network. It will consist in the structural and dynamic explanation of the observable phenomena in the data that describe the network. Through this methodology, competencies CB1, CB3, CG4, CG8, CE26 and CE27 are developed.
Autonomous problem solving	Autonomous resolution of problems and exercises related to the contents taught in the lectures. Through this methodology, competencies CB1, CB3, CG4, CG8, CE26 and CE27 are developed.
Lecturing	Synthetic exposition of the basic concepts that support the subject. Through this methodology, competencies CB1, CB3, CG4, CG8, CE26 and CE27 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Individual attention to the students to solve the doubts that may arise in the study of the material of the lectures.
Project based learning	Individual attention to students to solve the doubts that may arise in the development of the project.
Autonomous problem solving	Individual attention to students to solve the doubts that may arise in the autonomous resolution of the problems.

Assessment

	Description	Qualification	Evaluated Competencess		
Project based learning	Functional test of the project and quality of the conclusions.	30	CB1 CB3	CG4 CG8	CE26 CE27
Autonomous problem solving	Correction of the proposed exercises.	30	CB1 CB3	CG4 CG8	CE26 CE27
Essay questions exam	Written exam of essay questions about the contents of the subject.	30	CB1 CB3	CG4 CG8	CE26 CE27
Objective questions exam	Written exam of objective questions about the contents of the subject.	10	CB1 CB3	CG4 CG8	CE26 CE27

Other comments on the Evaluation

We leave to discretion of the students two methods of alternative assessment in the subject: continuous assessment and single assessment.

The continuous assessment will consist in the realisation of a written final exam (40% of the qualification), the development of a practical project (30% of the qualification) and the written resolution of problems and exercises along the course (30%

of the qualification). The single assessment will consist in the realisation of a written final exam (60% of the qualification) and in the development of a practical project (40% of the qualification) that will be delivered before the last day of the official period of exams.

The students will choose one or another modality of assessment at the time when the development projects are announced.

All those students who attend the written final exam and/or deliver the project will be considered as presented.

Those students who do not pass the subject at the first call have a second call in the month of July in which his/her knowledge will be re-evaluated with a written exam and/or his/her project will be re-evaluated if it had been improved or modified. The weights of each one of the tests (exam and project) will be the same that in the ordinary period of exams according to the modality that had been chosen.

The qualifications of the tests have only effects in the academic course in that they were awarded, with independence of the itinerary of evaluation chosen.

Sources of information

Basic Bibliography

M. O. Jackson, **Social and economic networks**, Princeton University Press, 2010

M. Newman, **Networks**, OUP Oxford, 2018

A.-L. Barabasi, **Network science**, Cambridge University Press, 2016

Complementary Bibliography

R. van der Hofstad, **Random graphs and complex networks**, Cambridge University Press, 2016

D. Easley, J. Kleinberg, **Networks, Crowds, and Markets: Reasoning About a Highly Connected World**, Cambridge University Press, 2010

B. Bollobas, **Random Graphs**, Cambridge University Press, 2001

Recommendations

Contingency plan

Description

In case of online tuition, the same methodologies will be used and the same proofs will be carried out that would have been developed in classroom at School.

Online tuition will be supported by Campus Remoto and Faitic.

IDENTIFYING DATA				
Internship in Companies I				
Subject	Internship in Companies I			
Code	V05M145V01324			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Marcos Acevedo, Jorge			
Lecturers	Marcos Acevedo, Jorge			
E-mail	acevedo@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The student develops own functions in a company as an Telecommunication Engineer with determinate profile by the technology that the student have studied (Electronics, Processed of signal for communications, Radiocommunication and Telematic) and supervised by the University adviser and the company adviser.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CG9	CG9 Ability to understand the responsibility and professional ethics in the activity of the profession of Telecommunications Engineering.
CG10	CG10 Ability to apply principles of economics and human resources and projects management, as well as legislation, regulation and standardization of telecommunications.
CG12	CG12 Skills for lifelong, self-directed and autonomous learning.
CG13	CG13 Knowledge, understanding and ability to implement the necessary legislation in the exercise of the profession of Telecommunication Engineering.

Learning outcomes	
Learning outcomes	Competences
Experience in the practice of the profession of engineering of Telecommunication and his/her usual functions in some real company environment.	CB2 CB5 CG8 CG9 CG10 CG12 CG13

Contents	
Topic	
Item	The student will realise a stay in the company developing own functions of a/to Engineer/to of Telecommunication.

Planning			
	Class hours	Hours outside the classroom	Total hours
Practicum, External practices and clinical practices	120	0	120
Report of practices, practicum and external practices(Repetida non usar)	5	0	5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Practicum, External practices and clinical practices	Stay in a company developing functions of an Telecommunication Engineer.

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	The student develops own functions in a company as an Telecommunication Engineer with determinate profile by the technology that the student have studied (Electronics, Processed of signal for communications, Radiocommunication and Telematic).

Assessment

	Description	Qualification	Evaluated Competencess	
Report of practices, practicum and external practices(Repetida non usar)	Activities memory Company tutor evaluation	100	CB2 CB5	CG8 CG9 CG10 CG12 CG13

Other comments on the Evaluation

REPORT OF ACTIVITIES: The student must submit a report explaining the activities undertaken during practices, specifying its duration, departments of the company that were conducted, training received (courses, software, etc.), the level of integration within the company and personal relationships.
The report must also include a section of conclusions, containing a reflection on the adequacy of the lessons learned during the university studies to performance practice (negative and positive aspects significant related to the development of practices). It also assessed the inclusion of information on the professional and personal experience with the practices (personal assessment of learning achieved over practices or own contributions and suggestions on the structure and operation of the company visited).
The assessment of memory will be 60% of the final qualification.
COMPANY TUTOR EVALUATION: The company tutor will submit a report assessing aspects with the practices carried out by students: punctuality, attendance, responsibility, teamwork ability and integration in the enterprise, quality of work done, etc.
The assessment of the tutor in the company will be 40% of the final qualification.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

It is recommended that the student have the greatest possible number of subjects studied and / or passed.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information

IDENTIFYING DATA				
Internship in Companies II				
Subject	Internship in Companies II			
Code	V05M145V01325			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Marcos Acevedo, Jorge			
Lecturers	Marcos Acevedo, Jorge			
E-mail	acevedo@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The student develops own functions in a company as an Telecommunication Engineer with determinate profile by the technology that the student have studied (Electronics, Processed of signal for communications, Radiocommunication and Telematic) and supervised by the University adviser and the company adviser.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CG9	CG9 Ability to understand the responsibility and professional ethics in the activity of the profession of Telecommunications Engineering.
CG10	CG10 Ability to apply principles of economics and human resources and projects management, as well as legislation, regulation and standardization of telecommunications.
CG12	CG12 Skills for lifelong, self-directed and autonomous learning.
CG13	CG13 Knowledge, understanding and ability to implement the necessary legislation in the exercise of the profession of Telecommunication Engineering.

Learning outcomes	
Learning outcomes	Competences
Experience in the practice of the profession of ingineering of Telecommunication and his usual functions in some real company environment.	CB2 CB5 CG8 CG9 CG10 CG12 CG13

Contents	
Topic	
Item	The student will realise a stay in the company developing own functions of a/to Engineer/to of Telecommunication.

Planning			
	Class hours	Hours outside the classroom	Total hours
Practicum, External practices and clinical practices	120	0	120
Report of practices, practicum and external practices(Repetida non usar)	5	0	5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Practicum, External practices and clinical practices	Stay in a company developing functions of an Telecommunication Engineer.

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	The student develops own functions in a company as an Telecommunication Engineer with determinate profile by the technology that the student have studied (Electronics, Processed of signal for communications, Radiocommunication and Telematic).

Assessment

	Description	Qualification		Evaluated Competencess
Report of practices, practicum and external practices(Repetida non usar)	Activities memory Company tutor evaluation	100	CB2 CB5	CG8 CG9 CG10 CG12 CG13

Other comments on the Evaluation

REPORT OF ACTIVITIES: The student must submit a report explaining the activities undertaken during practices, specifying its duration, departments of the company that were conducted, training received (courses, software, etc.), the level of integration within the company and personal relationships.
The report must also include a section of conclusions, containing a reflection on the adequacy of the lessons learned during the university studies to performance practice (negative and positive aspects significant related to the development of practices). It also assessed the inclusion of information on the professional and personal experience with the practices (personal assessment of learning achieved over practices or own contributions and suggestions on the structure and operation of the company visited).
The assessment of memory will be 60% of the final qualification.
COMPANY TUTOR EVALUATION: The company tutor will submit a report assessing aspects with the practices carried out by students: punctuality, attendance, responsibility, teamwork ability and integration in the enterprise, quality of work done, etc.
The assessment of the tutor in the company will be 40% of the final qualification.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

It is recommended that the student have the greatest possible number of subjects studied and / or passed.

Contingency plan

Description

=== ADAPTATION OF THE METHODOLOGIES ===
* Educational Methodologies that keep
Any because the subject consists of the permanence in a company developing activities adapted to the degree

* Educational Methodologies that modify
All. The subject sewed in the stay in the company of the student during a time. In the case that the teaching was exclusively no face-to-face, the practice in the company only will be able to make if it does in the remote.

* Modifications (if they proceed) of the contents to give
There are no changes

* Additional Bibliography to facilitate the self-learning
There are not

* Other modifications
There are not more modifications

=== ADAPTATION OF THE EVALUATION ===
Unchanged

IDENTIFYING DATA				
Internship in Companies III				
Subject	Internship in Companies III			
Code	V05M145V01326			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Marcos Acevedo, Jorge			
Lecturers	Marcos Acevedo, Jorge			
E-mail	acevedo@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The student develops own functions in a company as an Telecommunication Engineer with determinate profile by the technology that the student have studied (Electronics, Processed of signal for communications, Radiocommunication and Telematic) and supervised by the University adviser and the company adviser.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CB5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CG9	CG9 Ability to understand the responsibility and professional ethics in the activity of the profession of Telecommunications Engineering.
CG10	CG10 Ability to apply principles of economics and human resources and projects management, as well as legislation, regulation and standardization of telecommunications.
CG12	CG12 Skills for lifelong, self-directed and autonomous learning.
CG13	CG13 Knowledge, understanding and ability to implement the necessary legislation in the exercise of the profession of Telecommunication Engineering.

Learning outcomes	
Learning outcomes	Competences
Experience in the practice of the profession of ingineering of Telecommunication and his usual functions in some real company environment.	CB2 CB5 CG8 CG9 CG10 CG12 CG13

Contents	
Topic	
Item	The student will realise a stay in the company developing own functions of a/to Engineer/to of Telecommunication.

Planning			
	Class hours	Hours outside the classroom	Total hours
Practicum, External practices and clinical practices	120	0	120
Report of practices, practicum and external practices(Repetida non usar)	5	0	5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Practicum, External practices and clinical practices	Stay in a company developing functions of an Telecommunication Engineer.

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	The student develops own functions in a company as an Telecommunication Engineer with determinate profile by the technology that the student have studied (Electronics, Processed of signal for communications, Radiocommunication and Telematic).

Assessment

	Description	Qualification		Evaluated Competencess
Report of practices, practicum and external practices(Repetida non usar)	Activities memory Company tutor evaluation	100	CB2 CB5	CG8 CG9 CG10 CG12 CG13

Other comments on the Evaluation

REPORT OF ACTIVITIES: The student must submit a report explaining the activities undertaken during practices, specifying its duration, departments of the company that were conducted, training received (courses, software, etc.), the level of integration within the company and personal relationships.
The report must also include a section of conclusions, containing a reflection on the adequacy of the lessons learned during the university studies to performance practice (negative and positive aspects significant related to the development of practices). It also assessed the inclusion of information on the professional and personal experience with the practices (personal assessment of learning achieved over practices or own contributions and suggestions on the structure and operation of the company visited).
The assessment of memory will be 60% of the final qualification.
COMPANY TUTOR EVALUATION: The company tutor will submit a report assessing aspects with the practices carried out by students: punctuality, attendance, responsibility, teamwork ability and integration in the enterprise, quality of work done, etc.
The assessment of the tutor in the company will be 40% of the final qualification.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

It is recommended that the student have the greatest possible number of subjects studied and / or passed.

Contingency plan

Description

=== ADAPTATION OF THE METHODOLOGIES ===
* Educational Methodologies that keep
Any because the subject consists of the permanence in a company developing activities adapted to the degree

* Educational Methodologies that modify
All. The subject sewed in the stay in the company of the student during a time. In the case that the teaching was exclusively no face-to-face, the practice in the company only will be able to make if it does in the remote.

* Modifications (if they proceed) of the contents to give
There are no changes
* Additional Bibliography to facilitate the self-learning
There are not
* Other modifications
There are not more modifications

=== ADAPTATION OF THE EVALUATION ===
Unchanged

IDENTIFYING DATA				
Network Information Theory				
Subject	Network Information Theory			
Code	V05M145V01327			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Learning in Networks and Collaborative Work				
Subject	Learning in Networks and Collaborative Work			
Code	V05M145V01328			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Human-Computer Interaction				
Subject	Human-Computer Interaction			
Code	V05M145V01329			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Photovoltaic Power Electronics				
Subject	Photovoltaic Power Electronics			
Code	V05M145V01330			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Doval Gandoy, Jesús			
Lecturers	Doval Gandoy, Jesús Martínez-Peñalver Freire, Carlos			
E-mail	jdoval@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The subject describes the basic concepts of control and power electronic converters used in photovoltaic systems.			

Competencies	
Code	
CB2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE28	CE28/SE1 Capacity of technology integration of photovoltaic conversion for power systems of Telecommunication Engineering.

Learning outcomes	
Learning outcomes	Competences
Knowledge of power conversion technologies used in photovoltaic systems.	CB2 CG4 CG8 CE28
Knowledge of control techniques of electronic power converters used in photovoltaic systems.	CB2 CG4 CG8 CE28

Contents	
Topic	
Chapter 1: Introduction to photovoltaic systems	Photovoltaic effect. Electrical characteristics of photovoltaic cells. Temperature dependence. Irradiation dependence. Electrical connection. Shadow effect.
Chapter 2: Topologies of power electronics converters in photovoltaics.	Electrical configuration photovoltaic cells. Topologies of power electronics converters.
Chapter 3: Control of photovoltaic inverters.	Control of stand-alone photovoltaic inverters. Control of grid-connected photovoltaic inverters. Synchronisation. Maximum power point tracking.
Chapter 4: Regulations and Standards in power electronics photovoltaics systems.	International regulations: IEEE, IEC, VDE, EN. Power quality, ride-through, anti-islanding.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	10	31	41
Problem solving	5	16	21
Lecturing	15	48	63
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Laboratory practical	Application of the knowledge to particular situations and acquisition of basic skills related with the topic. Competencies: CB2, CG4, CG8, CE28/SE1.
Problem solving	Formulation of problems and/or exercises related with the topic. The student has to develop the correct solutions by means of applying routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results. Competencies: CB2, CG4, CG8, CE28/SE1.
Lecturing	The professor presents the contents on the subject: theoretical basis and/or guidelines of the work to be developed by the students. Competencies: CB2, CG4, CG8, CE28/SE1.

Personalized assistance

Methodologies	Description
Lecturing	The professor will attend personally doubts and queries of the students, on the study of theoretical concepts, on exercises or on practices of laboratory. The students will have occasion to attend personal tutorials at the professor office. The tutorial hours will be published at the beginning of the semester in the website of the subject.
Laboratory practical	The professor will attend personally doubts and queries of the students, on the study of theoretical concepts, on exercises or on practices of laboratory. The students will have occasion to attend personal tutorials at the professor office. The tutorial hours will be published at the beginning of the semester in the website of the subject.
Problem solving	The professor will attend personally doubts and queries of the students, on the study of theoretical concepts, on exercises or on practices of laboratory. The students will have occasion to attend personal tutorials at the professor office. The tutorial hours will be published at the beginning of the semester in the website of the subject.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	Development of the practices of laboratory.	33	CB2	CG4 CG8	CE28
Problem solving	Resolution of exercises proposed	33	CB2	CG4 CG8	CE28
Lecturing	Theoretical concepts.	34	CB2	CG4 CG8	CE28

Other comments on the Evaluation

There are two ways to evaluate the students: continuous evaluation or single evaluation.

1. Continuous evaluation

The continuous evaluation consists in the evaluation of the tasks proposed by the professor along the course. The students will execute the tasks and will deliver a report of each one of the tasks. The professor may ask students questions about the tasks carried out in order to assess the knowledge acquired.

The professor will score the students from their work in the developed tasks and from the reports.

The marks will be valid only for the current academic course. It is understood that the student chooses the continuous evaluation when he/she presents at least one task. His/her qualification will be the one of continuous evaluation.

2. Single evaluation

The final examination is for students that do not participate in the continuous evaluation. It consists of theoretical questions, problems and exercises that will evaluate the knowledge of the student in the topic. The examination date will be established by the head of the Faculty.

3.Second call

There is a second opportunity to pass the subject. The student will have to pass an exam with questions, problems and exercises that will evaluate the knowledge of the student in the topic. The examination date will be established by the head of the Faculty.This examination is the same for all the students, have followed or no the continuous evaluation.

Sources of information

Basic Bibliography

Remus Teodorescu, Marco Liserre, Pedro Rodríguez, **Grid Converters for Photovoltaic and Wind Power Systems**, John Wiley & Sons, Ltd.,

Complementary Bibliography

Ned Mohan, Tore M. Undeland, William P. Robbins, **Power Electronics: Converters, Applications, and Design**, John Wiley & Sons, Ltd.,

Andrés Barrado Bautista, Antonio Lázaro Blanco, **Problemas de electrónica de potencia**, Pearson Educación,

Recommendations

Contingency plan

Description

=== MEDIDAS EXCEPCIONALES PLANIFICADAS ===
Ante la incierta e imprevisible evolución de la alerta sanitaria provocada por el COVID-19, la Universidad de Vigo establece una planificación extraordinaria que se activará en el momento en que las administraciones y la propia institución lo determinen atendiendo a criterios de seguridad, salud y responsabilidad, y garantizando la docencia en un escenario no presencial o parcialmente presencial. Estas medidas ya planificadas garantizan, en el momento que sea preceptivo, el desarrollo de la docencia de un modo más ágil y eficaz al ser conocido de antemano (o con una amplia antelación) por el alumnado y el profesorado a través de la herramienta normalizada e institucionalizada de las guías docentes.

=== ADAPTATION OF THE METHODOLOGIES ===

Lecturing: it can be taught virtually through campusvirtual from UVigo.

Laboratory practical: it can be taught virtually through campusvirtual from UVigo.

Problem solving: it can be taught virtually through campusvirtual from UVigo.

Tutorship: the teacher can tutor students virtually through the campusvirtual from Uvigo.

No need to modify contents.

No need to add additional bibliography.

=== ADAPTATION OF THE TESTS ===

The evaluation mechanism is maintained.

IDENTIFYING DATA				
Signal Conditioners				
Subject	Signal Conditioners			
Code	V05M145V01331			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Quintáns Graña, Camilo			
Lecturers	Quintáns Graña, Camilo			
E-mail	quintans@uvigo.es			
Web	http://faitic.uvigo.es			
General description	In this subject the electronic circuits that condition the signals generated by sensors to be efficiently coupled to a data acquisition system or to a digital processor are studied. It is a subject that follows the Design of Analog Electronic Circuits, which is coursed in the first course of the master. Thus, in this new subject the basic conditioning circuits are expanded by including measuring active bridges, alternating current conditioning circuits, etc. Another important aspect that is included in the study is the evaluation of the measurement uncertainty. Student learns to characterize a measure provided by a sensor through the calibration curve and the uncertainty. The theory is complemented by laboratory practices that focus on providing students with the skills needed to address the realization of a complete measurement system, from the physical system up to the user interface. The key points of the laboratory work are: -The followed methodology to measure physical variables to the calculation of uncertainties. -Characterization of transducers. -Topologies of conditioning circuits. -The connection of the conditioned signals to a digital processor. -Instrumentation software for digitally conditioning and user interfaces.			

Competencies	
Code	
CG1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
CG4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CE29	CE29/SE2 Ability to build a system of a physical variable measured from the transducer to the user interface, including knowledge of methodology, basic topologies of conditioning signal and instrumentation software

Learning outcomes	
Learning outcomes	Competences
To know the modeling and simulationing of analogic electronic systems by means of the hardware description language SPICE.	CG1 CG4 CG8 CE29
To know the evaluationing of the uncertainties in the measuring processes following the standards.	CG4
To know how to handle and to program data acquisition systems.	CG1 CE29
To know the developing of complex electronic circuits for conditioning the sensors.	CG1 CG4 CG8 CE29
To konw to analyse and to design circuits for interfaces between the sensors and digital processors.	CG1 CE29
To know how to develop an instrumentation electronic systems.	CG1 CG4 CG8 CE29

Contents
Topic

Unit 1: Introduction to the measuring systems of physical variables.	Functional and working characteristics of sensors. Evaluation of measurement data. Sensor calibration. Measurement uncertainties. Parts of a conditioning circuit. Types of conditioners.
Unit 2: Introduction to the metrology. Evaluation of measurement uncertainty.	Methodology to measure and to calibrate sensors. Terminology. Statistical method.
Unit 3. Circuits to conditioning signal from measured sensors.	Active measuring bridges in direct and alternating current. Ac/dc converters. Selection and design of filtering stages. Frequency to voltage converters. Conditioners for output stages.
Unit 4: Interfaces between on-off sensors and digital processors.	Basic concepts of local interfaces of on-off sensors. Interfaces with and without galvanic isolation. Coupling in alternating and continuous current.
Unit 5: Conditioning circuits for inductive and magnetic measure sensors.	Study of the conditioners for several inductive and magnetic sensors according to his application.
Unit 6: Conditioning circuits for capacitive measureing sensors.	Study of the conditioners for capacitive sensors.
Unit 7: Conditioning circuits for generators sensors.	Study of the conditioning circuits for generators sensors according to his physical working principle.
Unit 8: Practical cases of conditioning circuits for measuring sensors.	Study of real cases with commercial sensors and circuits.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	1	1.5
Lecturing	7	14	21
Mentored work	4.5	9	13.5
Problem solving	6	12	18
Laboratory practical	7	14	21
Laboratory practice	1	12	13
Essay	0.5	1	1.5
Essay questions exam	1	15	16
Problem and/or exercise solving	1	15	16
Report of practices, practicum and external practices	0.5	2	2.5
Systematic observation	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Introductory activities	Activities aimed at making contact and gathering information about the students, as well as presenting the subject.
Lecturing	Exhibition by the teacher of the reports on the subject matter of study, theoretical bases and / or guidelines of a work, exercise that the student has to develop.
Mentored work	The student, individually or as a group, carries out activities, which can be: - Monographic works, search of information in publications, databases, articles, books ... on a specific topic. - Preparation of seminars, research, reports, essays, conferences, etc. - Reviews on current scientific articles. - Projects (design and develop projects).
Problem solving	Activity in which problems and / or exercises related to the subject are formulated. The student must develop the correct solutions through the exercise of routines, and application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results.
Laboratory practical	Activities of application of knowledge and concrete situations, and acquisition of basic and procedural skills, related to the object of study. They are developed in special spaces with specialized equipment (laboratories, computer rooms, etc.).

Personalized assistance

Methodologies	Description
Lecturing	The professor will attend personally doubts and queries of the students on the study of the theoretical concepts and the exercises. The tutorships will do in the office of the professor in the schedule that establish at the beginning of the course and that will publish in the page Web of the subject.
Laboratory practical	The professor will attend personally doubts and queries of the students on the preparation of the practices of laboratory. The tutorships will do in the office of the professor in the schedule that establish at the beginning of the course and that will publish in the page Web of the subject.

Mentored work	The professor will attend personally doubts and queries of the students on the upervised works. The tutorships will do in the office of the professor in the schedule that establish at the beginning of the course and that will publish in the page Web of the subject.
Problem solving	The professor will attend personally doubts and queries of the students on the resolution of the problems. The tutorships will do in the office of the professor in the schedule that establish at the beginning of the course and that will publish in the page Web of the subject.

Tests	**Description**
Report of practices, practicum and external practices	The professor will attend personally doubts and queries of the students on the preparation and presentation of the memories of the results of the laboratory practices. The tutorships will do in the office of the professor in the schedule that establish at the beginning of the course and that will publish in the page Web of the subject.

Assessment

	Description	Qualification	Evaluated Competencess	
Laboratory practice	Execution practices of real or simulated tasks. These are tests in which the performance of the students will be evaluated on the basis of the knowledge shown, the behavior, organization and planning during the practice, reflection on the results obtained, etc.	20	CG1 CG4 CG8	CE29
Essay	It is a text prepared on a topic and should be written following established rules.	10	CG1 CG4 CG8	CE29
Essay questions exam	Tests that include open questions about a topic. Students must develop, relate, organize and present the knowledge they have about the subject in an extensive response.	20	CG1 CG4 CG8	CE29
Problem and/or exercise solving	Test in which the student must solve a series of problems and / or exercises in a time / conditions established by the teacher. In this way, students must apply the knowledge acquired.	25	CG1 CG4 CG8	CE29
Report of practices, practicum and external practices	Preparation of a report by the student in which the characteristics of the work carried out are reflected.	15	CG1 CG4 CG8	CE29
Systematic observation	Attentive, rational, planned and systematic perception to describe and record the manifestations of student behavior.	10	CG8	

Other comments on the Evaluation

1. First call: Continuous assessment

The continuous evaluation consists of the following four parts:

1.-Laboratory (35%), which is divided into:

Development of laboratory practices: Monitoring (10%) plus the practical test (10%).

Report of laboratory practices (15%).

2.-Theory exams (45%), which is divided in an orientation way in:

Development questions (20%).

Problems (25%).

3.-Tutored work (10%), in which the results will be presented in a report of the C group.

4.-Systematic observation (10%). In addition to the aspects mentioned in the description, the participation of the student in carrying out the activities proposed for their autonomous work and the use of personalized attention in the office hours of the teacher will be taken into account.

The final grade, which is scored on a maximum of 10 points, is the sum of the mark of each part if the following conditions are met:

1.-Have carried out a minimum of the 80% of the laboratory practices.

2.-Obtain a minimum mark of the 40% in each part of the assessment.

If it does not fulfill any of the previous requirements, the final mark will be the sum of the marks of each part, but limited to the 40% of the maximum note (4 points). Students who do not reach a minimum score of 40% in the laboratory evaluation,

exams and supervised work in the continuous assessment may recover them in the second opportunity tests while maintaining the percentages of the continuous assessment.

To pass, the students have to obtain an equal total mark or upper to the 50% of the maximum mark (5 points).

The practical test will take place near of the last session of laboratory classes. The development questions and problems will can be divided in two sessions spread along the period of teaching.

2. First call: Final exam

Students who fail the course in continuous assessment (have not performed, at least, 80% of the practices) can will take a final exam.

The final exam will consist of a practical and a theoretical test, each corresponding to 50% of the total mark. To pass the student must obtain at least the 40% in each part and must sum a total of at least 5 points.

The students of continuous evaluation that have pending to surpass the minimum of some part will be able to do it in the final examination. If they did not reach the minimum in the supervised work, they will have a deadline to present the proposed improvements until the final exam.

3. Second call

In the second call the assessment will be like the final exam of the first call.

Sources of information

Basic Bibliography

Pallás Areny, Ramón, **Sensors and signal conditioning**, Second Edition, John Wiley & Sons, inc., 2001

European co-operation for Accreditation, **Expression of the Uncertainty of Measurement in Calibration**, September 2013 rev 02, EA-4/02 M, 2013

Complementary Bibliography

Philip R. Bevington and D. Keith Robinson, **Data Reduction and Error Analysis for the Physical Sciences**, McGraw Hill, 2003

Grupo de Trabajo 1 del Comité Conjunto de Guías en Metrología (JCGM / WG 1), **Guía para la Expresión de la Incertidumbre de Medida**, 2008

C. Quintáns, **Simulación de Circuitos Electrónicos con OrCAD 16 DEMO**, 1, Marcombo, 2008

Recommendations

Subjects that it is recommended to have taken before

Digital and Analog Mixed Circuits/V05M145V01213
Analog Electronic Circuits Design/V05M145V01106
Advanced Digital Electronic Systems/V05M145V01203

Contingency plan

Description

In the case to happen to a stage of teaching totally no face-to-face will apply the following extraordinary measures:

Theory
The contents and his distribution in the distinct parts will keep independently of the format of teaching, face-to-face or no face-to-face.

Laboratory
In this part of laboratory, all the practices will make using a simulator of electronic circuits (available in version of free access), except those that require of the use of instrumentation and specific equipment. In case that along the period of teaching alternate with situations of face-to-face teaching and no face-to-face, will be able to adapt the planning as far as possible to carry out in the laboratory those practices that require of the use of instrumentation and specific equipment.

Documentation and bibliography
As in the situation of normal conditions, the no face-to-face teaching will base in the documentation and other didactic resources that the educational team will put to disposal of the students in the FAITIC platform of the University and of the available basic bibliography in the library.

Evaluation
The contents and the distribution of marks in the evaluation, in both continuous and final, will keep independently of the format of teaching, face-to-face or no face-to-face.
As in the no face-to-face teaching, the objective acts of assessment will carry out in a synchronous way and using the remote available tools in CAMPUS REMOTO and FAITIC. In the practical part will be used the same platform and, moreover, the same free access simulator used in the practices.

IDENTIFYING DATA				
Electronic Equipments Implementation and Exploitation				
Subject	Electronic Equipments Implementation and Exploitation			
Code	V05M145V01332			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Marcos Acevedo, Jorge			
Lecturers	López Sánchez, Óscar Marcos Acevedo, Jorge			
E-mail	acevedo@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	This subject includes concepts related with dependability analysis of complex electronic systems as well as their models. Also includes metodologies for electronic systems design for safety applications and EMC analysis. Finally it includes asset management and human resources.			

Competencies	
Code	
CG3	CG3 Ability to lead, plan and monitor multidisciplinary teams.
CG7	CG7 Capacity for implementation and management of manufacturing processes of electronic and telecommunications equipment; guaranteeing safety for persons and property, the final quality of the products, and their homologation.
CE30	CE30/SE3 Capacity planning, evaluation and decision-making in new environments relating to the packaging of networks, services and applications in the electromagnetic field, with knowledge of reliability and life cycle costing

Learning outcomes	
Learning outcomes	Competences
Ability to make an analysis of electromagnetic compatibility of an electronic system according the standards	CG7
Ability to design electronic equipment that includes specifications of maintainability and availability	CG7 CE30
Ability to specify the stocks level required for a given equipment maintainability	CG7
Ability to determine the life cycle cost of a product	CE30
Capacity to implement and manage the operation of electronic equipment	CG7
Ability to the assets management of an organization, related to the subject	CG3
Ability to understand the impact of risks, human reliability and knowledge management, in an organization	CG3

Contents	
Topic	
Item 1: Dependability analysis of electronic systems.	Reliability allocation and optimization. Maintainability and availability analysis. Product life cycle.
Item 2: Modeling of electronic systems for dependability applications.	Markov models and Petri Nets.
Item 3: Failure analysis.	Failure modes of electronic components. Analysis of failure mechanisms and causes of the failure modes. Standards.
Item 4: Fail-safe systems.	Fault-safe systems specification. Design methodologies. Validation. Practical examples.
Item 5: Production and assembly of equipment electronic.	Materials and manufacturing processes. Mounting technologies. Lifetime assays. Installation cautions.
Item 6: Electromagnetic compatibility.	Analysis of EMC in circuits, systems and electronic equipments. Circuits and systems in living areas. Circuits and equipment systems of information technologies. Circuits and systems in automotive systems. Applications.
Item 7: Asset Management.	Asset management types. Management of physical assets: The Standard. Competence frames.
Item 8: The intellectual capital in organizations.	Intangible assets: Management. Human capital. Decision making.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	0	18
Laboratory practical	10	15	25
Problem solving	0	10	10
Mentored work	0	40	40
Objective questions exam	2	0	2

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

Methodologies

	Description
Lecturing	It will develop in the schedules fixed by the direction of the engineering school. It consist of a presentation by the teacher, of the contents of the subject. Also proceed to solving examples and/or problems that illustrate the problems to be solved adequately. The student may submit all doubts and questions deemed appropriate, during the session. We will promote the more active participation of the student possible. Competencias CG7, CG3 and CE30/SE3 are used
Laboratory practical	Students will perform practical examples of dependability analysis of electronic control systems, according to standards. The analysis will performed with specific software application. Competencies CG7 and CG3 are used
Problem solving	In this educational activity we will propose problems and/or exercises subject related. They are also used to highlight the doubts and also for feedback to teachers on this aspect. Competencias CG7, CG3 and CE30/SE3 are used
Mentored work	It consists in carrying out specific tasks that are elated to the subject and in collaboration with xternal entities, provided that this is possible. Competencias CG7, CG3 and CE30/SE3 are used

Personalized assistance

Methodologies	Description
Lecturing	The teacher will personally attend doubts and queries of students, on the study of theoretical, laboratory or projects. Students will have opportunity to attend individual tutorials or in groups in the teacher's office on schedule to be established for this purpose at the beginning of the course and to be published on the page of the subject.
Laboratory practical	The teacher will personally attend doubts and queries of students, on the study of theoretical, laboratory or projects. Students will have opportunity to attend individual tutorials or in groups in the teacher's office on schedule to be established for this purpose at the beginning of the course and to be published on the page of the subject.
Problem solving	The teacher will personally attend doubts and queries of students, on the study of theoretical, laboratory or projects. Students will have opportunity to attend individual tutorials or in groups in the teacher's office on schedule to be established for this purpose at the beginning of the course and to be published on the page of the subject.
Mentored work	The teacher will personally attend doubts and queries of students, on the study of theoretical, laboratory or projects. Students will have opportunity to attend individual tutorials or in groups in the teacher's office on schedule to be established for this purpose at the beginning of the course and to be published on the page of the subject.

Assessment

	Description	Qualification	Evaluated Competencess	
Problem solving	Deliverables, problems and exercises will be assess.	40	CG3 CG7	CE30
Mentored work	They will evaluate the contents (methodology of development, conclusions obtained, exhibition of results and capacity of work in team) For works in team the indivual note will be the same for all members of the team	50	CG3 CG7	CE30
Objective questions exam	Exam of theory questions and / or exercises	10	CG3 CG7	CE30

Other comments on the Evaluation

The deliverables of the troubles and exercises are provide for guidance, for weeks 2, 4, 6 and 8.

Following the own guidelines of the degree and the agreements of the academic commission, offers to the students the option of continuous evaluation or single evaluation in the date established by the centre.

The students that choose continuous evaluation will have to communicate it to the professor during the first week of class. The continuous evaluation supposes:

a) The students realise the problems and exercises proposed by the professor and deliver them in time and form. Maximum assessment 4 points (40% of the final note). Will have to obtain a minimum note of 2 points. These tasks will not be recoverable later.

b) The students realise a supervised work, in group. This work will procure , whenever it was possible, that realise with a company or external institution to the University. In this case the students will go to the company when it was necessary, for the realisation of the work. Maximum assessment 5 points (50% of the final note). Will have to obtain a minimum note of 2,5 points.

c) The students realise a exam of theory questions and/or exercices. Maximum assessment 1 point (10%).

Students do not exceed any of the two minimum requirements, the rating will be the lower of the average grade of the two scores and 4.5 points.

Students working in groups will have the same grade.

The single evaluation by first call or second call, involves:

a) That the students perform and deliver on exam day, the exercises and problems posed in the subject, which is referred to in paragraph a) above. Maximum rating 4 points (40% of the final mark). The students must obtain a minimum of 2 points.

b)That the students to take an exam with questions and problems 2h corresponding to both the theoretical and laboratory. Maximum rating 6 points (60% of the final grade). The students must obtain a minimum of 3 points.

Students in single evaluation do not exceed any of the two minimum requirements, the rating will be the lower of the average grade of the two scores and 4.5 points.

It demands an ethical behaviour by part of the students. In case of plagiarism detection in any of the works/test realised the final qualification of the matter will be "suspense (0)" and the professors will communicate to the school direction the problem so that it take the measures that consider timely.

Sources of information

Basic Bibliography

David J. Smith, **Reliability, Maintainability and Risk**, 8ª, Butterworth Heinemann, 2011

López Veraguas, Joan Pere, **Compatibilidad electromagnética y seguridad funcional en sistemas electrónicos**, Marcombo, 2010

I. Fernández, A. Camacho, C. Gasco, A.M. Macías, M.A. Martín, G. Reyes, J. Rivas, **Seguridad Funcional en Instalaciones de Proceso: Sistemas Instrumentados de Seguridad y Análisis SIL**, ISA, 2012

M. Goble, H. Cheddie, **Safety Instrumented Systems Verification**, ISA, 2005

M. Goble, **Control Systems Safety Evaluation and Reliability**, 3ª, ISA, 2010

Michael D. Medoff Rainer and I. Faller, **Functional Safety: An IEC 61508 SIL 3 Compliant Development Process**, 3ª, Exida, 2014

Complementary Bibliography

T.I. Bajenescu, M.I. Bâzu, **Reliability of Electronic Components**, Springer-Verlag, 1999

P. Kales, **Reliability**, Prentice-Hall, 1998

B. R. Mehta Y. J. Reddy, **Industrial Process Automation Systems Design and Implementation**, Elsevier, 2015

ISO, **UNE-ISO 55000:2015: Gestión de activos. Aspectos generales, principios y terminología**, AENOR, 2015

Milton Ohring, **Reliability and Failure of Electronic Materials and Devices**, 2ª, Elsevier, 2015

Chris J. O´Brien, **Final Elements in Safety Instrumented Systems**, 1ª, Exida, 2018

Shahriyar Kaboli, **Reliability in Power Electronics and Electrical Machines: Industrial Applications and Performance Models**, 1ª, IGI Global, 2016

Francesco Flammini, **Railway Safety, Reliability, and Security: Technologies and Systems Engineering**, 1ª, 2012

Recommendations

Subjects that are recommended to be taken simultaneously

Signal Conditioners/V05M145V01331
Photovoltaic Power Electronics/V05M145V01330

Subjects that it is recommended to have taken before

Digital and Analog Mixed Circuits/V05M145V01213
Hardware/Software Design of Embedded Systems/V05M145V01214
Integrated Circuits Design and Manufacturing/V05M145V01215

Contingency plan

Description

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
All methodologies are maintained except for the practices of the laboratory. The other methodologies carried out in remote.

* Teaching methodologies modified
The practices of the laboratory will see modified of the following form: Of the 5 planned practices, 4 could be made of remote form since they base in the utilization of a PC and specific software. In the case of online tuition, we would look for an alternative so that the students can use it also in the remote. The other practice would do in the remote. The professor shows by means of a video the operation of the place of work and of his equipment takes the measures and the students treat said information and elaborate the corresponding memory.

* Modifications (if applicable) of the contents
There are no changes.

* Additional bibliography to facilitate self-learning
There are no changes. It will follow using the included bibliography in point 8, in addition to the additional documentation that is in FAITIC.

* Other modifications
There are not more modifications.

=== ADAPTATION OF THE TESTS ===
The continuous evaluation does not change since it bases on the realization of tasks and works, so much individual how in a group, in addition to the realization of the practices of the laboratory. In the case of teaching, a non-face-to-face exam the presentation of the works will be in a remote.

If any student opts by the only evaluation, so much in first how in the second opportunity, the evaluation neither changes, excepting that the examination will be realized also in a remote.

IDENTIFYING DATA				
Electronic Equipment Practicals				
Subject	Electronic Equipment Practicals			
Code	V05M145V01333			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Telecommunications Seminar				
Subject	Telecommunications Seminar			
Code	V05M145V01334			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Piezoelectric Transducers and Applications				
Subject	Piezoelectric Transducers and Applications			
Code	V05M145V01335			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Numerical Linear Algebra in Telecommunications Engineering				
Subject	Numerical Linear Algebra in Telecommunications Engineering			
Code	V05M145V01336			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	5	Optional	2nd	1st
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Master Thesis				
Subject	Master Thesis			
Code	V05M145V01401			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	30	Mandatory	2nd	2nd
Teaching language	Spanish English			
Department				
Coordinator	Fernández Veiga, Manuel			
Lecturers	Fernández Veiga, Manuel			
E-mail	mveiga@det.uvigo.es			
Web	http://faiticuvigo.es			
General description	The Master Thesis (TFM) forms part, like module, of the plan of studies of the title of Master in Engineering of Telecommunication. It is an original and personal work that each student realises of autonomous form under educational permission, and has to allow him show of form integrated the acquisition of the formative contents and the competitions associated to the title. His definition and contents are explained of form more extensive in the rule for the realisation of the TFM, whose content can consult in the web of the School of Telecommunication Engineering.			

Competencies	
Code	
CB1	CB1 Knowledge and understanding needed to provide a basis or opportunity for being original in developing and/or applying ideas, often within a research context.
CG1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
CG5	CG5 Capacity for development, strategic planning, direction, coordination and technical and financial management of projects in all fields of Telecommunication Engineering following quality and environmental criteria.
CG8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
CG11	CG11 Ability to communicate (oral and written) conclusions, and the knowledge and reasons supporting them, to specialists and non-specialists in a clear and unambiguous way.
CG12	CG12 Skills for lifelong, self-directed and autonomous learning.
CE17	CE17/TFM Embodiment, presentation and defense, once all credits of the curriculum are passed, of an original exercise performed individually in front of a university jury, consisting of a comprehensive project of Telecommunication Engineering with professional nature, in which skills acquired in the teachings are synthesized.

Learning outcomes	
Learning outcomes	Competences
Research, classification and structuring of information on some topic relevant to Telecommunications engineering.	CB1 CG8 CG12
Dissertation containing the fundamentals, the solution and an analysis of results about the problem addressed. It should include a review of the state of the art, an explanation of the methodology or approach, and a discussion of results.	CG1 CG8 CG11 CE17
Design of prototypes, computer programs, circuits, procedures, algorithms, designs, methods, etc, complying to specifications	CB1 CG1 CG5 CG8 CG12

Contents	
Topic	
The contents of the Master's Thesis are established in the individual proposals offered by the advisors, according to the rules issued by the Academic Commission of the Master Programme, which is published in the website of the School of Telecommunications Engineering	The subject of each work is specific, given the individual character of the work.

Planning			
	Class hours	Hours outside the classroom	Total hours

Previous studies	0	60	60
Case studies	0	20	20
Project based learning	0	630	630
Problem solving	0	30	30

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

Methodologies

	Description
Previous studies	Research, reading and work of documentation, proposals of resolution of problems and/or exercises that will realise in the classroom or the laboratory of autonomous form by the students.
Case studies	It carries out a critical analysis of similar problems to the posed in the thesis, with the goal of extracting ideas, analogies, methods or partial results that help in the resolution of the problem posed in the thesis.
Project based learning	The student, individually, solves a scientific problem, originally and independently, within the thematic area of his/her interest, and is able to write a dissertation with the hypotheses, the solution and the conclusions of his work.
Problem solving	The student analyzes the possible solutions to a scientific problem proposed for the thesis, and elaborates a synthesis solution (analytical, meteorological, experimental or combined) that allow him to fulfill the stated goals.

Personalized assistance

Methodologies	Description
Project based learning	Each student will meet his/her advisors to receive guidance, orientation or academic assistance on the objectives, the methodology, the analysis of results and the presentation of the thesis.

Assessment

	Description	Qualification	Evaluated Competencess	
Project based learning	The assessment is done after an oral presentation and defence in front of an examining committee. In the evaluation, the Committee might take into account the opinions or the report issued by the advisor, as well as questions like the quality of the presentation, the review of the state of the art, the quality of the technical proposal, the novelty and importance of the results, the capacity of initiative of the student, etc. System of qualifications: it will express by means of numerical final qualification of 0 to 10 according to the valid legislation.	100	CB1	CG1 CG5 CG8 CG11 CG12 CE17

Other comments on the Evaluation

All the information related with the Master's Thesis can be accessed on the web of the School of Engineering of Telecommunication. Students and professors can also see individual information about the Master's Thesis in their online administrative office.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Contingency plan

Description

In the event that the teaching activities have to be suspended or restricted due to a public health situation, all the activities spanned by the Master's thesis will be carried out online through the tools enabled by the University of Vigo. Eventually, the public defense of the thesis will take place online, too. The laboratory duties will be replaced by other equivalent activities, agreed between advisors and their students, which guarantee the fulfillment of the competences and can be executed online.