



## IDENTIFYING DATA

### Engineering of Electronic Equipment

Subject	Engineering of Electronic Equipment			
Code	V05G301V01313			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	López Sánchez, Óscar			
Lecturers	López Sánchez, Óscar Nogueiras Meléndez, Andres Augusto			
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Web	<a href="http://moovi.uvigo.gal/">http://moovi.uvigo.gal/</a>			
General description	This course shows the basics concepts about RAMS (Reliability, Availability, Maintainability and Safety) of electronic components and electronic systems, as well as techniques to follow for a study of this type or design a system that meets specifications RAMS. the basics concepts about the sources of electromagnetic interference and their minimization are also discussed.			
	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

## Training and Learning Results

Code	
B1	CG1: The ability to write, develop and sign projects in the field of Telecommunication Engineering, according to the knowledge acquired as considered in section 5 of this Law, the conception and development or operation of networks, services and applications of Telecommunication and Electronics.
B2	CG2: The knowledge, comprehension and ability to apply the needed legislation during the development of the Technical Telecommunication Engineer profession and aptitude to manage compulsory specifications, procedures and laws.
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
B8	CG8: To know and apply basic elements of economics and human resources management, project organization and planning, as well as the legislation, regulation and standarization in Telecommunications.
B9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
C41	(CE41/SE3):The ability to make the specification, implementation, documenting and tuning of electronic systems and equipment ( both instrumentation and control oriented), considering the corresponding technical aspects and the regulations.
C47	(CE47/SE9): The ability to analyze and solve interference and electromagnetic compatibility problems .
D4	CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
Knowledge of the applicable standards in the design of the electronic systems	B6
Ability for the specification of components and electronic systems	C41 C47
Knowledge and application of techniques to meet EMC standards	C47

Knowledge of techniques and tools for the design and manufacture of an electronic system based on dependability specifications	B2 B6 B8	
Ability to design, implement and manage a dependability system	B1	
Ability to manage the knowledge of the organization	B9	D4

## Contents

Topic	
Introduction to the reliability	Definitions and basic concepts. RAMS Technologies. Parameters of the reliability of electronic components. Prediction of reliability. Related technical standards.
Reliability of electronic systems	Series, parallel and redundant systems. Optimization of redundancies.
Maintenance and security	Definitions, type and parameters of the maintenance. Availability. Definitions of electronic systems for safety applications. Safety levels of systems.
Analysis of failures	Failure Mode and Effects and Criticality Analysis (FMECA). Failure Tree Analysis (FTA). Markov's models. Mathematical models of Arrhenius, Eyring, Reverse power and Coffin-Manson.
Electromagnetic interferences	Definitions. Basics of electromagnetic interferences. Sources of interferences.
Design for electromagnetic compatibility	Basics of electronic devices design. Componentes to minimize interferences. Techniques for eliminate interferences.
Electromagnetic compatibility standards	CE marking. Directive of electromagnetic compatibility. Organisms for standardization. Electromagnetic compatibility standards.
Laboratory exercises	Several simulation practices and measurements will be carried out in the laboratory. Accounting will be calculated using specific software and measurements of conducted and radiated emissions will be made.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	14	28	42
Problem solving	7	18	25
Case studies	7	0	7
Mentored work	0	60	60
Laboratory practical	14	0	14
Essay questions exam	1	0	1
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
Lecturing	Presentation of the contents of the subject by the teaching staff. Examples and problems will be solved to illustrate properly the topic under study. The students may submit all doubts and questions deemed appropriate, during the session. We will promote the more active participation of the student possible. They Will work the competences B1, B2, B6, B8, B9, C41 and C47.
Problem solving	Teaching activities with problems develop, case studies and exercises related to the subject. Also it be used to show existing doubts and also for feedback to teachers. Competences trained: B1, B2, B6, C47 and C41.
Case studies	The groups are conducted with a small number of students and are used for the development of group work and learning methodologies teamwork. Group activity.  Competencies B1, B2, C41 and D4 are used.
Mentored work	Autonomous works related with the contents of the subject. Students will work on the competences B6, B8, B9, C41, C47 and D4.
Laboratory practical	Reliability calculation calculation using specific software. Measurement of emitted and radiated emissions. Students will work the competences B2, C41 and D4.

## Personalized assistance

### Methodologies Description

Lecturing Teachers will personally address doubts and queries of the students about theoretical and practical issues. The schedule and the appointed procedure will be published in the online learning platform. Students can appoint for tutorial at the website of the University of Vigo:  
<https://www.uvigo.gal/es/universidad/administracion-personal/pdi/oscar-lopez-sanchez>,  
<https://www.uvigo.gal/es/universidad/administracion-personal/pdi/andres-augusto-nogueiras-melendez>.

<b>Assessment</b>				
	Description	Qualification	Training and Learning Results	
Mentored work	The students will realize one or several works about the contents of the subject. The works can be individual or in group and they will be qualified individually. It cannot be retaken.	15	B6 B8 B9	C41 D4
Laboratory practical	Students will carry out various practical simulations and measurements in the laboratory. They will be done in groups. The correct execution of the practical exercises in the laboratory and the memory of the results will be assessed. Non-attendance or non-delivery of the report of results will be qualified as suspended (0). They cannot be retaken.	15	B2 B6 B8	C41 D4 C47
Essay questions exam	First partial test. Written test with theoretical questions on part of the content of the subject. It will be held on the date and place set by the center. It can be retaken in the extraordinary assessment call.	35	B1 B2 B6 B8 B9	C41 D4 C47
Objective questions exam	Second partial test. Written test with theoretical questions, problems and exercises on the contents of the subject not included in the first partial test. It will be held on the date and place set by the center. It can be retaken in the extraordinary assessment call.	35	B1 B2 B6 B8 B9	C41 D4

#### **Other comments on the Evaluation**

Choosing of global assessment must be communicated in writing to the coordinator within one month of the start of the semester.

The end-of-program exam will be by global assessment.

The global assessment will consist of an individual written test with theoretical questions, problems and exercises that will evaluate all the content of the subject (85%) and a practical exam that will be carried out in the laboratory (15%). In case of detection of copying or 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**

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

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

David J. Smith, **Reliability, Maintainability and Risk**, 8<sup>a</sup>, Butterworth Heinemann, 2011

Kececioglu, Dimitri, **Reliability Engineering Handbook**, DEStech, 2002

Antonio Creus Solé, **Fiabilidad y seguridad: Su aplicación en procesos industriales**, Marcombo, 2005

Henry W. Ott, **Electromagnetic Compatibility Engineering**, Wiley, 2011

J. Balcells, F. Daura, R. Esparza e R. Pallás, **Interferencias Electromagnéticas en Sistemas Electrónicos**, Marcombo, 1991

Milton Ohring, **Reliability and Failure of Electronic Materials and Devices**, 2<sup>a</sup>, Elsevier, 2015

##### **Complementary Bibliography**

ISO, **UNE-EN ISO 9000:2005: Sistemas de gestión de la calidad. Fundamentos y vocabulario.**, AENOR, 2005

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

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

Cherry Bhargava, **AI Techniques for Reliability Prediction for Electronic Components**, 1<sup>a</sup>, IGI Global, 2020

#### **Recommendations**

##### **Subjects that are recommended to be taken simultaneously**

Data Acquisition Systems/V05G301V01314

**Subjects that it is recommended to have taken before**

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Digital electronics/V05G301V01203

Physics: Fundamentals of electronics/V05G301V01201

Electronic technology/V05G301V01206

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**Other comments**

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This version in English of the guide is a translation of the original one in Galician. In the case that, by mistake, there exists differences between them the original one in Galician is what prevails.

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