



IDENTIFYING DATA

Engineering of Electronic Equipment

Subject	Engineering of Electronic Equipment			
Code	V05G300V01523			
Study programme	Degree in Telecommunications Technologies Engineering - In extinction			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	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 course shows students 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.			

Competencies

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.

Learning outcomes

Expected results from this subject	Training and Learning Results	
Knowledge of the applicable standards in the design of electronic systems	B2	C41
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	
Item 1: Introduction	Definitions. Reliability Basics. RAMS Technologies. Statistical functions. Reliability Management.
Item 2: Reliability of electronic components	Definitions. Parameters (Failure rate, MTBF, MTTF). Reliability prediction of electronic components. Regulations.
Item 3: Reliability of electronic systems	Series systems. Redundant systems. Reliability allocation. Redundancy optimization. Standards.
Item 4: Maintainability and Availability	Definitions and types of maintenance. Parameters (Repair rate, MTTR). Stocks management. Availability of series and parallel systems. Regulations.
Item 5: Safety	Definitions. Electronic systems for safety applications. Safety level or safety category determination for safety electronic systems. Standards.
Item 6: Reliability tools	Failure mode effects analysis and criticalities (FMECA). Fault Tree (FTA). Markov Models. Standards.
Item 7: Essays	Types and test plans. Accelerated tests. Standards.
Item 8: Electromagnetic Interferences	Definitions. Fundamentals of electromagnetic interferences. Sources of interference. Minimization elements. Standards.
Item 9: Dependability management I	R + D + i. Lifecycle. Continuous improvement: management and assurance. Support tools.
Item 10: Dependability management II	HR and strategic management. Teamwork and improvement systems. Support tools.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	6	12	18
Laboratory practical	8	0	8
Mentored work	0	60	60
Case studies	7	0	7
Lecturing	21	32	53
Presentation	0	4	4

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

Methodologies

	Description
Problem solving	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. Individual activity. Competencies CG1, CG2, CG6, CE47 and CE41 are used
Laboratory practical	The students learn how to perform reliability calculations by using specific software for this application. Individual activity. Competencies CG2, CE41 and CT4 are used
Mentored work	Specific works that are related to the content of the subject and in partnership with a company or outside entity. Whenever possible, the student will develop two jobs one of them in collaboration with AENOR and another in collaboration with a company's environment. Group activity. Competencies CG6, CG8, CG9, CE41, CE47 and CT4 are used
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 CG1, CG2, CE41 and CT4 are used.
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. Group activity. Competencies CG1, CG2, CG6, CG8, CG9, CE41, and CE47 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.
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.
Case studies	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	Training and Learning Results		
Problem solving	Deliverables, problems and exercises will be assess.	30	B1	C41	
			B2	C47	
			B6		
Laboratory practical	The deliverables of the proposed laboratory practices will be evaluated.	10	B2	C41	D4
Mentored work	They will evaluate the contents (methodology of development, conclusions obtained, exhibition of results, capacity of work in team, capacity of work in multidisciplinary team) in the work in collaboration with the company. Also will take into account the opinion of the tutor in the company. The other work in collaboration with UNE will value the quality of the work realised and the capacity of work in team. For works in team the individual note will be the same for all members of the team	40	B6	C41	D4
			B8	C47	
			B9		
Presentation	The results of the work carried out will be evaluated, as well as the student's ability to answer the questions asked.	20	B9		D4

Other comments on the Evaluation

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

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

Students who choose the continuous assessment should inform the instructor during the first two weeks of class.

Continuous assessment involves:

a) The students should do the problems and exercises and it will be delivered to the teacher. Maximum rating 4 points (40% of the final grade). The students must obtain a minimum of 2 points. These tasks are not recoverable later.

b) The students should do in group two jobs. One of them in collaboration with UNE and students of the Faculty of Philology and Translation, and another in collaboration, with a company's environment, to whose installations will go the students when it was necessary. Maximum rating 6 points (60% of the final grade). The students must obtain a minimum of 3 points.

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 eventual assessment by the first call or second call or extraordinary 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 the eventual assessment 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.

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

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

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

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

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

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

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**, 2ª, 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**, 1ª, 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

Digital electronics/V05G301V01203

Physics: Fundamentals of electronics/V05G301V01201

Electronic technology/V05G301V01206

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 7 planned practices, 5 could be made of remote form since they base in the utilization of a PC and specific software. Of the two programs of specific software used, one of them could them happen to the students so that they install it and use in his own computers and for the another, if it is not possible we would look for an alternative so that the students can use it also in the remote. The other two practices 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.

* Non-attendance mechanisms for student attention (tutoring)

The attention of the students would make in remote by videoconference, email, and telephone.

* 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, although it is likely that includes some additional articles.

* Other modifications

There are not more modifications

=== ADAPTATION OF THE TESTS ===

The continuous evaluation will follow the same criteria of previous courses since it bases on the realization of tasks and

works, so much individual as in a group. In addition to the realization of the practices of the laboratory. In the case of online tuition, then the presentation of the works will be in a remote.

If some student opts by the only evaluation, so much in first as in the second opportunity, the evaluation neither changes, excepting that the examination will be made also in the remote.
