ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

53001649 - Electronic Design For Reliability

DEGREE PROGRAMME

05BI - Doble Master Universitario Ingenieria Industrial - Electronica Industrial

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	53001649 - Electronic Design For Reliability
No of credits	3 ECTS
Type	Optional/elective
Academic year ot the programme	Second year
Semester of tuition	Semester 4
Tuition period	February-June
Tuition languages	English
Degree programme	05BI - Doble Master Universitario Ingenieria Industrial - Electronica Industrial
Centre	05 - E.T.S. De Ingenieros Industriales
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Pedro Alou Cervera (Subject coordinator)	Electrónica	pedro.alou@upm.es	Sin horario. Previa petición de hora
Jaime Señor Sanchez		jaime.senors@upm.es	Sin horario. Previa petición de hora

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.2. Research assistants

Name and surname	Email	Faculty member in charge
Maldonado Roldan, Gabriel Luis	gl.maldonado.roldan@upm.es	Alou Cervera, Pedro

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Digital Electronics

- Analog Electronics

- Basic Knowledge on Power Electronics

4. Skills and learning outcomes *

4.1. Skills to be learned

MUEI.CE01 - Comprender, diseñar y analizar sistemas y componentes electrónicos en el ámbito de la electrónica industrial. Modelización y caracterización de sistemas electrónicos complejos.

MUEI.CE02 - Ser capaz de desarrollar un proyecto de diseño de un sistema electrónico, identificando sus principales retos, en ámbitos de aplicación tales como el aeroespacial, la automoción, la ingeniería médica, las energías renovables o las comunicaciones.

MUEI.CG01 - Haber adquirido conocimientos avanzados y demostrado, en un contexto de investigación científica y tecnológica o altamente especializado, una comprensión detallada y fundamentada de los aspectos teóricos y prácticos y de la metodología de trabajo en uno o más campos de estudio.

MUEI.CG02 - Saber aplicar e integrar sus conocimientos, la comprensión de estos, su fundamentación científica y sus capacidades de resolución de problemas en entornos nuevos y definidos de forma imprecisa, incluyendo contextos de carácter multidisciplinar tanto investigadores como profesionales altamente especializados.

MUEI.CT01 - Uso de la lengua inglesa

MUEI.CT05 - Gestión de la información

4.2. Learning outcomes

RA88 - Diferenciar y clasificar que afectan a la fiabilidad en función de la aplicación, especialmente en sistemas embarcados en vehículos o aeronaves

RA90 - Aplicar los conocimientos teóricos adquiridos dentro de la asignatura para el diseño de sistemas críticos orientados a la alta fiabilidad

RA89 - Identificar los factores más importantes que afectan a la fiabilidad de los sistemas, discriminando aquellos que son críticos

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Esta asignatura tienen un caracter teórico-práctico, donde se estudian los conceptos relacionados con la fiabilidad de los sistemas eléctrónicos. El enfoque metodológico se basa en ir de lo más general o abstracto a lo concreto, finalizando en el estudio de pautas y recomendaciones concretas en el diseño de sistemas eléctronicos para aplicaciones críticas.

5.2. Syllabus

1. Introduction

2. Reliability and Availability

   2.1. Probability distribution of Failures

   2.2. Combinational modelling

   2.3. State Space modelling

3. Analysis techniques

   3.1. Part Stress Analysis (PSA)

      3.1.1. Derating Techniques

      3.1.2. Thermal management

      3.1.3. HI-REL components

   3.2. Failure rate calculation: MOSFET, capacitor, ...

   3.3. Reliability calculation of a system: Space application

   3.4. Worst Case Analysis (WCA)

      3.4.1. Component Tolerances

      3.4.2. Stability of a System

      3.4.3. Montecarlo Analysis

   3.5. Failure modes and criticality analysis (FMECA)

4. Design techniques for dependability

   4.1. Design for Fault tolerance

   4.2. Prognostic Health management

   4.3. Space Power Distribution System: Design for Fault tolerance

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	**Introduction to safety-critical systems** Duration: 02:00 Lecture			
2	**Reliability and Availability** Duration: 02:00 Lecture			
3	**Reliability and Availability** Duration: 02:00 Lecture			
4	**Analysis techniques** Duration: 02:00 Lecture			
5	**Stability Analysis of Satellite Power distribution Systems** Duration: 02:00 Lecture			
6	**Worst Case Analysis** Duration: 02:00 Lecture			**Tasks to be done along the semester. Individual wok.** Individual work Progressive assessment and Global Examination Not Presential Duration: 08:00
7	**Worst Case Analysis. Montecarlo simulation** Duration: 02:00 Laboratory assignments			
8	**Reliability Calculation** Duration: 02:00 Lecture			
9	**Reliability Calculation** Duration: 02:00 Problem-solving class			
10	**Reliability Calculation. Hot and Cold Redundant systems** Duration: 02:00 Lecture			
11	**Failure Mode Analysis** Duration: 02:00 Lecture			
12	**Design techniques for dependability** Duration: 02:00 Lecture			

13	**Design techniques for dependability** Duration: 02:00 Lecture			
14	**Design techniques for dependability** Duration: 02:00 Lecture			
15				
16				
17				**Examen escrito** Written test Progressive assessment and Global Examination Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	Tasks to be done along the semester. Individual wok.	Individual work	No Presential	08:00	30%	5 / 10	MUEI.CG02 MUEI.CG01 MUEI.CT01 MUEI.CT05 MUEI.CE01 MUEI.CE02
17	Examen escrito	Written test	Face-to-face	02:00	70%	5 / 10	

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	Tasks to be done along the semester. Individual wok.	Individual work	No Presential	08:00	30%	5 / 10	MUEI.CG02 MUEI.CG01 MUEI.CT01 MUEI.CT05 MUEI.CE01 MUEI.CE02
17	Examen escrito	Written test	Face-to-face	02:00	70%	5 / 10	

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

The tasks done along the semester will have a 30% weight in the evaluation and the exam will have a 70% weight. In both cases it is necessary to achieve at least 5 over 10.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Software Engineering. Ian Sommerville	Bibliography	9th Edition. Pearson Education INc.
Military Handbook for Electronic Reliability Design	Bibliography	DoD. MIL-HDBK-338B, 1998
Prognostics and Health Managem. Michael G. Pechtent of Electronics	Bibliography	
NASA Hw design Handbook	Bibliography	
Simplis Simetrics	Equipment	CAD tool for simulate electronic circuits. It will be available in the PCs of the Lab and it is used to run Montecarlo analysis

9. Other information

9.1. Other information about the subject

La asignatura se relaciona con el ODS 9 desde el punto de vista del diseño de sistemas electrónicos robustos y fiables para la industria