



## Teaching Guide

Identifying Data					2023/24
Subject (*)	Design of Electronic Equipment	Code	77G01060		
Study programme	Grao en Enxeñaría Electrónica Industrial e Automática				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	2nd four-month period	Fourth	Optional	4.5	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Enxeñaría Industrial				
Coordinador	Rivas Rodriguez, Juan Manuel	E-mail	m.rivas@udc.es		
Lecturers	Rivas Rodriguez, Juan Manuel	E-mail	m.rivas@udc.es		
Web					
General description	This course trains the student for the final design of electronic equipment, including the selection of materials, design of printed circuit boards, assembly process and final verification.				

## Study programme competences

Code	Study programme competences
A2	Capacidade para planificar, presupostar, organizar, dirixir e controlar tarefas, persoas e recursos.
A3	Capacidade para realizar medicións, cálculos, valoracións, taxacións, peritaxes, estudos e informes.
A4	Capacidade de xestión da información, manexo e aplicación das especificacións técnicas e da lexislación necesarias no exercicio da profesión.
A5	Capacidade para analizar e valorar o impacto social e medioambiental das solucións técnicas actuando con ética, responsabilidade profesional e compromiso social, e buscando sempre a calidade e mellora continua.
A6	Capacidade para a resolución dos problemas matemáticos que se poidan suscitar na enxeñaría. Aptitude para aplicar os coñecementos sobre: álgebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
A29	Capacidade para deseñar sistemas electrónicos analóxicos, dixitais e de potencia.
A30	Coñecer e ser capaz de modelar e simular sistemas.
A34	Capacidade para deseñar sistemas de control e automatización industrial.
B1	Capacidade de resolver problemas con iniciativa, toma de decisións, creatividade e razoamento crítico.
B2	Capacidade de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
B3	Capacidade de traballar nun contorno multilingüe e multidisciplinar.
B4	Capacidade de traballar e aprender de forma autónoma e con iniciativa.
B5	Capacidade para empregar as técnicas, habilidades e ferramentas da enxeñaría necesarias para a práctica desta.
B6	Capacidade de usar adecuadamente os recursos de información e aplicar as tecnoloxías da información e as comunicacións na enxeñaría.
B7	Capacidade para traballar de forma colaborativa e de motivar un grupo de traballo.
C2	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.

## Learning outcomes

Learning outcomes	Study programme competences		
Learn about the entire manufacturing process for electronic equipment.	A2	B1	C2
	A3		
	A6		



Designs printed circuits according to their electrical, mechanical and thermal characteristics.	A3 A29 A30 A34	B1 B2 B3 B4 B5 B6 B7	C2
Recognize and select the different types of electronic cases.	A3	B5 B6	C2
Know the limits of permitted electromagnetic emissions, how to determine them, combat them and get immunity to them.	A3 A4	B5	
Learn about the manufacturing, assembly and testing process of electronic equipment.	A4 A5	B4 B5	

Contents	
Topic	Sub-topic
Topic 1: Electronic components.	Theoretical models vs real models of components. Encapsulated - Insert components (THD). - Surface mount components (SMD)
Topic 2: Design, manufacture and assembly of printed circuits.	Types of substrates. Types of layers. Multilayer circuits. Wave soldering. Reflow soldering. Other types of welding. Manufacturing - Manual processes. - Automated processes
Tema 3: EMC and EMI in electronic equipment design.	Magnetic fields. Emissions, Susceptibility, and ESD Normative

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student's personal work hours	Total hours
Case study	A3 A4 B1 B3 C2	8	12	20
Guest lecture / keynote speech	A2 A6 B1	14	0	14
Supervised projects	A3 A29 B4 B5 B6	14	30	44
Objective test	B1 B2 B5	2.5	0	2.5
Document analysis	A4 A5 B2 C2	5	0	5
Laboratory practice	A3 A4 A5 A30 A34 B3 B5 B7 C2	22	0	22
Personalized attention		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	
Methodologies	Description
Case study	One or more cases of commercial equipment will be studied in regards to its manufacturing process.



Guest lecture / keynote speech	Exposición oral e mediante do uso de medios audiovisuais, realizando preguntas ós estudantes.
Supervised projects	Deberán ser realizados de forma individual por cada alumno.
Objective test	Proba escrita sobre coñecimentos teóricos.
Document analysis	Utilización das ferramentas actuais para a localización, documentación e adquisición de componentes electrónicos.
Laboratory practice	Deseñaranse un ou varios circuitos electrónicos. Deberán facerse de modo individual.

### Personalized attention

Methodologies	Description
Laboratory practice Supervised projects	It will be held in the classroom during the performance of supervised work and laboratory practices. Also during the tutoring hours and may be in person or telematically, preferably by Teams.

### Assessment

Methodologies	Competencies	Description	Qualification
Laboratory practice	A3 A4 A5 A30 A34 B3 B5 B7 C2	Work done or in the laboratory in person or telematically through simulation.	30
Supervised projects	A3 A29 B4 B5 B6	Made individually. Delivered electronically by Moodle	30
Objective test	B1 B2 B5	Individual written test. Made in person or by Moodle.	40

### Assessment comments

To pass the course it will be necessary to obtain a minimum of 40% of the maximum grade for each of the three parts.
--

### Sources of information

<b>Basic</b>	- Altium (2022). Manuales de referencia. <a href="https://resources.altium.com/es/p/getting-started-pcb-design">https://resources.altium.com/es/p/getting-started-pcb-design</a> Manual de referencia de KiCad. (2020)., KiCad EDA. A Cross Platform and Open Source Electronics Design Automation Suite. Recuperado de <a href="https://kicad-pcb.org/">https://kicad-pcb.org/</a> Manual de referencia de KiCad. (2020)., KiCad EDA. A Cross Platform and Open Source Electronics Design Automation Suite. Recuperado de <a href="https://kicad-pcb.org/">https://kicad-pcb.org/</a>
<b>Complementary</b>	- Ronald A. Reis (1999). Electronic Project Design and Fabrication. Prentice Hall- Varios fabricantes (varios). Hojas de características de distintos componentes.

### Recommendations

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

Technical Office/770G01035  
Analog Electronics/770G01022  
Digital Electronics/770G01023  
Electronic Instrumentation I/770G01027  
Industrial Drawing and CAD/770G01029

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

#### Subjects that continue the syllabus

#### Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.