Teaching Guide				
Identifying Data				2020/21
Subject (*)	Design of Electronic Equipment		Code	770G01060
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	Esta asignatura capacita ó alumno para o deseño final de equipos electrónicos, incluindo aa selección de materiais, deseño das placas de circuito impreso, proceso de montaxe e de verificación final.			
Contingency plan	1. Changes in content No modification will be made to the content 2. Methodologies * Teaching methodologies that are maintained Master Session, Practices, Tutored Works, Mixed Test * Teaching methodologies that are modified 3. Mechanisms for personalized attention to students Both the master session and the practices will be carried out through the Microsoft Teams platform. Tutoring schedules are maintained through the Microsoft Teams platform and email. 4. Modifications in the evaluation The mixed test and practical tests will be carried out through the Moodle platform. * Evaluation observations: The minimum necessary to pass the subject are maintained in those methodologies that have not been modified. 5. Modifications of the bibliography or webgraphy No modifications will be made			

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: álxebra 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 A3 A6	B1	C2
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.		B6	C2
Learn about the manufacturing, assembly and testing process of electronic equipment.	A3	B5	
Know the limits of permitted electromagnetic emissions, how to determine them, combat them and get immunity to them.	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	A4 A5 A29 B4	8	12	20
Guest lecture / keynote speech	A2 A6 B1	14	0	14
Supervised projects	A29 A3 B5 B6	14	30	44
Objective test	B1 B2 B5	2.5	0	2.5
Document analysis	B3 C2	5	0	5
Laboratory practice	A3 A4 A30 A34 B3 B5 B7 C2	27	0	27
Personalized attention		0		0
(*)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 eletrónicos.
Laboratory practice	Deseñaranse un ou varios circuitos electrónicos. Deberán facerse de modo individual.

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

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	
Basic	Manual de referncia de KiCad. (2020)., KiCad EDA. A Cross Platform and Open Source Electronics Design Automation Suite. Recuperado de https://kicad-pcb.org/ Manual de referncia de KiCad. (2020)., KiCad EDA. A Cross Platform and Open Source Electronics Design Automation Suite. Recuperado de https://kicad-pcb.org/
Complementary	- 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.