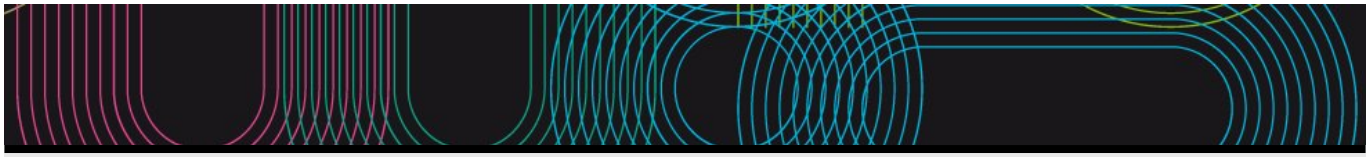

IDENTIFYING DATA				
Power Electronics				
Subject	Power Electronics			
Code	V05G300V01625			
Study programme	Degree in Telecommunications Technologies Engineering - In extinction			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	López Sánchez, Óscar			
Lecturers	Doval Gandoy, Jesús López Sánchez, Óscar			
E-mail	olopez@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The main goal of this subject is to provide students with the knowledge about the basics of power electronics. Contents include power semiconductor and magnetic devices, ac-dc converters, dc-dc converters, dc-ac converters and basic concepts about the control of these power converters. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
A1	Students have demonstrated knowledge acquisition and understanding in the field of study. This knowledge begins based on general secondary education, and it is typically at a level that, although advanced textbooks would support it, includes some aspects at the forefront of their field of study.
C43	(CE43/SE5): The ability to design analogical and digital electronics circuits of analogical to digital conversion and vice versa, of radiofrequency, of feeding and electrical energy conversion for computing and telecommunication engineering.
C44	(CE44/SE6): The ability to understand and use feedback theory and electronic control systems.

Learning outcomes		
Expected results from this subject		Training and Learning Results
Knowledge about power electronics semiconductor devices.		C43
Knowledge about the operation of the basic topologies of electronic converters used in conversion of electrical energy.	A1	C43
The ability to understand and analyse power electroncis circuits.		C43 C44
The ability to analyse and design the control loop of power electronics converters.		C43 C44
The ability to design basic circuits used in power electronic converters.		C43 C44

Contents	
Topic	
Chapter 1: Introduction to power electronics	Introduction, overview of power electronics, applications.
Chapter 2: Power electronic devices	Diode, MOSFET, IGBT. Switching, drivers, thermal analysis, association of devices, electrical protection.
Chapter 3: Magnetics in power electronics	Basics, inductors, transformers, magnetic materials.

Chapter 4: AC to DC power conversion	Three phase rectifiers. Non-controlled rectifiers, controlled rectifiers. Resistive load, inductive load, capacitive filter.
Chapter 5: DC to AC power conversion	Basics of DC to AC power conversion. Single phase and three phase inverters. Square wave inverters, PWM inverters. Modulation techniques.
Chapter 5: DC to DC power conversion	Basic DC to DC converter topologies. Converters without isolation and with isolation. Control in DC to DC power converters.
Laboratory exercise 1. Power electronic semiconductor devices.	MOSFET transistor, switching characteristics. Current and voltage characteristics.
Laboratory exercise 2. AC to DC power conversion	Non-controlled three phase rectifier, controlled three phase rectifier. Input/ output current and voltage.
Laboratory exercise 3. DC to AC power conversion	DC to AC converter. Input/ output current and voltage.
Laboratory exercise 4. DC to DC power conversion	Non-isolated and isolated DC to DC converter. Input/ output current and voltage.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	21	42	63
Laboratory practical	12	24	36
Autonomous problem solving	7	28	35
Problem and/or exercise solving	2	14	16

*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 by the professor of the contents of the subject, guidelines for the work to be developed by the student. Work will be focused on Competencies CE43 and CE44.
Laboratory practical	Practical application of the theoretical concepts. Work will be focused on Competencies CE43 and CE44.
Autonomous problem solving	Proposal of problems and/or exercises related with the subject contents. Students have to obtain the correct solutions. The professor will support and will help students to solve the problems. Work will be focused on Competencies CE43 and CE44.

Personalized assistance

Methodologies	Description
Lecturing	The students can attend tutorials in the professor office on dates and hours published in the web of the subject.
Laboratory practical	The students can attend tutorials in the professor office on dates and hours published in the web of the subject.
Autonomous problem solving	The students can attend tutorials in the professor office on dates and hours published in the web of the subject.

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	The laboratory practices are evaluated in a continuous way (session to session) taking into account their previous preparation and the execution in the laboratory.	10	C43 C44
Autonomous problem solving	The execution of several tasks and the corresponding reports are requested.	10	C43 C44
Problem and/or exercise solving	Exams consist of exercises and problems related to the theoretical and practical contents of the subject.	80	C43 C44

Other comments on the Evaluation

For the first and the second call, it will be possible to choose between continuous evaluation and single evaluation. Students that select single evaluation should notify this to the teachers during the very first two weeks of classes of the subject.

The end-of-program call will be by single evaluation.

The dates and classrooms of the written tests will be those approved and published by the Academic Commission of the Degree of the school.

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

1. Continuous evaluation

It consists of the realization of several weekly tasks, the preparation and execution of the laboratory practices, and the realization of two tests of partial evaluation.

1.1 Weekly tasks

Along the course, the execution of several individual tasks and the corresponding written report will be requested. These tasks will be no retakeable. By the correct realization of these tasks, it will be possible to obtain up to 10% of the final qualification of the subject.

1.2 Laboratory practices

There will be four sessions of laboratory practices in groups of two students, which will be both graded individually. The laboratory practices will be no retakeable. By the correct preparation and execution of the practices, it will be possible to obtain up to 10% of the final qualification of the subject.

1.3 Tests of partial evaluation

There will be two individual written tests of partial evaluation, in which will be possible to obtain up to 40% of the final qualification of the subject in each one of them. It will be possible to retake these tests in the second call.

1. **First partial test:** it will evaluate the contents taught to date of the test.
2. **Second partial test:** it will evaluate the remaining contents of the subject that were not included in the first test.

2. Single evaluation

It will be an individual written test consisting of theoretical questions, problems and exercises that will evaluate all the contents, theoretical and practical, of the subject.

Sources of information

Basic Bibliography

Mohan, Ned, **Electrónica de Potencia. Convertidores, Aplicaciones y Diseño**, 3, Mc Graw Hill, 2009
Barrado, Andrés, **Problemas de electrónica de potencia**, Pearson Prentice Hall, 2007
Rashid, Muhammad H., **Electrónica de potencia: circuitos, dispositivos y aplicaciones**, Pearson Education, 2004
Hart, Daniel W., **Electrónica de potencia**, Prentice-Hall, 2001

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Physics: Analysis of Linear Circuits/V05G301V01108
Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101
Mathematics: Calculus 2/V05G301V01106
Physics: Fundamentals of electronics/V05G301V01201
Electronic technology/V05G301V01206
Analogue Electronics/V05G301V01311

Other comments

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.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering

safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Lecturing. The same content will be taught, adapting the format of the exhibitions to online teaching, using the remote campus.
* Laboratory practices. They will be replaced by simulation exercises using a specific power electronics simulator. The exercises will become individual. The remote campus will be used to solve the doubts of the students.
* Autonomous problem solving. In-person sessions will be replaced by online sessions through the remote campus.

===PERSONALIZED ASSISTANCE===
The students can attend tutorials in the professor office of the remote campus.

=== ADAPTATION OF THE TESTS ===
* The written tests will be substituted by reports.