



## IDENTIFYING DATA

### Power Electronics

Subject	Power Electronics			
Code	V05G300V01625			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish Galician			
Department	Electronics Technology			
Coordinator	López Sánchez, Óscar			
Lecturers	Doval Gandoy, Jesús López Sánchez, Óscar			
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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 devices, AC-DC converters, DC-DC converters, DC-AC converters and basic concepts about the control of these power converters.			

## Competencies

Code	
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.	C43
The ability to understand and analyse power electronic 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. Input AC Introduction to the power factor correction.
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 practices	12	24	36
Autonomous problem solving	7	28	35
Problem 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 on the subject, guidelines for the work to develop by the student. Competencies CE43 and CE44 will be worked.
Laboratory practices	Practical application of the theoretical concepts. Competencies CE43 and CE44 will be worked.
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. Competencies CE43 and CE44 will be worked.

### Personalized attention

Methodologies	Description
Lecturing	The students can attend tutorials in the professor office on dates and hours published in the web of the subject.
Laboratory practices	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 practices	The laboratory practices are evaluated in a continuous way (session to session) taking into account his 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 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 opportunity of evaluation, 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 extraordinary examination 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.

Copy or plagiarism will be considered serious offenses that will lead to the involved students to fail the subject (0). Additionally, the school's board will be notified so they can take timely actions.

## 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 opportunity of evaluation.

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.

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### Sources of information

#### Basic Bibliography

Mohan, Ned, **Power electronics: converters, applications, and design**, John Wiley and Sons, 2003

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

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### Recommendations

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

Programmable Electronic Circuits/V05G300V01502

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

Physics: Analysis of Linear Circuits/V05G300V01201

Physics: Fields and Waves/V05G300V01202

Physics: Fundamentals of Mechanics and Thermodynamics/V05G300V01102

Digital Electronics/V05G300V01402

Physics: Fundamentals of Electronics/V05G300V01305

Electronic Technology/V05G300V01401

#### 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.