



## 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				
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 electronics 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
Master Session	21	42	63
Laboratory practises	12	24	36
Autonomous troubleshooting and / or exercises	7	28	35
Troubleshooting and / or exercises	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
Master Session	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 practises	Practical application of the theoretical concepts. Competencies CE43 and CE44 will be worked.
Autonomous troubleshooting and / or exercises	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
Master Session	The students can attend tutorials in the professor office on dates and hours published in the web of the subject.
Laboratory practises	The students can attend tutorials in the professor office on dates and hours published in the web of the subject.
Autonomous troubleshooting and / or exercises	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 practises	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 troubleshooting and / or exercises	Every week, students are commissioned the execution of tasks and the delivery of a execution report.	10	C43 C44
Troubleshooting and / or exercises	Each exam is composed by exercises and problems related to the theoretical concepts and laboratory practices. The number of exams and examination rules are detailed in "Other comments"	80	C43 C44

## Other comments on the Evaluation

For their evaluation, each student should select between continuous evaluation or evaluation by final examination.

### 1. Continuous evaluation

The continuous evaluation is carried out by means of the execution of several weekly tasks, the preparation and execution of the laboratory practices, and the execution of two tests of partial evaluation.

#### 1.1 Weekly tasks

Weekly, the professor will commission to the students to execution of several tasks and the delivery of an execution report. By the realization of the tasks and the delivery of the reports the students will be able to obtain the up to 10% of the qualification of the subject. The qualifications of the weekly tasks will be valid only for the current academic year.

## 1.2 Laboratory practices

Students will realize four sessions of laboratory practices in groups of two. Each group member will obtain an individual mark for each session that will evaluate the previous preparation and the execution of the practice in the laboratory. The sessions without assistance will be marked with a zero. The final mark of the laboratory practices will be the average of the marks of the four sessions. By the correct preparation and execution of all laboratory practices the students will be able to obtain up to 10% of the qualification of the subject. The qualifications of the laboratory practices will be valid only for the current academic year and the following one.

## 1.2 Tests of partial evaluation

Students will realize two written tests of partial evaluation. The partial tests are not recoverable, that is, if a student can not attend one test, the professors do not have obligation to repeat it. The qualifications of the partial tests will be valid only for the current academic year. It is considered that a student chooses the continuous evaluation and renounces to be evaluated by final exam if it attends the first of the partial tests.

1. **First partial test:** students will be evaluated of the contents taught to date of the test. The students will be able to obtain in this test up to 40% of the final qualification. This test will be held on week 8, approximately.
2. **Second partial test:** students will be evaluated of the contents taught to date of the test that were not included in the first partial test. The students will be able to obtain in this test up to 40% of the final qualification. This test will be held on a date and place chosen by the Dean of the Faculty for the final examination.

## 2. Evaluation by final examination

The final examination consists of theoretical questions, problems and exercises that covers the whole contents of the subject. The students will be able to obtain in this exam up to 100% of the final qualification. This exam will be held on the date and place chosen by the Dean of the Faculty..

## 3. Extraordinary examination (June-July)

The extraordinary examination consists of theoretical questions, problems and exercises that will evaluate the whole contents of the subject. The students will be able to obtain in this exam up to 100% of the final qualification. This exam will be held on the date and place chosen by the Dean of the Faculty.

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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.