



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			
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 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 electronicis 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: Basics of three phase electrical systems	Definition of electrical power under sinusoidal and non-sinusoidal conditions. Power factor, balanced and unbalanced three phase systems, sequence of phases, definition of power three phase systems.
Chapter 4: Magnetics in power electronics	Basics, inductors, transformers, magnetic materials.
Chapter 5: 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 6: 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 7: 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
Laboratory practises	12	24	36
Autonomous troubleshooting and / or exercises	7	28	35
Master Session	21	42	63
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
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.
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.

Personalized attention

Methodologies	Description
Master Session	
Laboratory practises	
Autonomous troubleshooting and / or exercises	

Assessment

	Description	Qualification	Training and Learning Results
Autonomous troubleshooting and / or exercises	(*)Semanalmente, o profesorado da materia encargará ao alumnado a execución de tarefas e a entrega do informe de execución.	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"	90	C43 C44

Other comments on the Evaluation

In this subject there are two ways to evaluate to the students: continuous evaluation or evaluation by final examination.

1. Continuous evaluation.

Consists in the execution of weekly tasks and the realisation of tests of partial evaluation.

1.1 Weekly tasks: weekly, the professor will commission to the students the execution of tasks and the delivery of the report of execution. To be able to approve the subject by continuous evaluation is compulsory to realise and deliver the reports in the term fixed by the professor. These tasks will evaluate the competencies CE43 and CE44. Students will be able to obtain 10% of the final qualification

1.2 Tests of partial evaluation: students will realise three written tests of partial evaluation. The partial tests are not recoverable, that is, if a student can not attend the test, professors do not have obligation to repeat them. The qualifications

of the partial tests will be valid only for the current academic year. It is understood that students choose continuous evaluation if they attend some of the partial tests. Their qualification will be the one of continuous evaluation. These tests will evaluate the competencies CE43 and CE44

1st partial test: students will be evaluated of the contents taught to date of the test. Students will be able to obtain in this test 25% of the final qualification. This test will be held about week 7.

2nd partial test: students will be evaluated of the contents taught to date of the test. Students will be able to obtain in this test 25% of the final qualification. This test will be held about week 11.

3rd partial test: it will be held during 60 minutes in the date and classroom of the final examination. Students will be evaluated of the contents taught to date of the test. Students will be able to obtain in this test 40% of the final qualification. This test will be held on a date chosen by the Dean of the Faculty (date final examination).

2. Evaluation by final examination

The final examination evaluates students that did not participate in continuous evaluation. Consists of theoretical questions, problems and exercises. Students will be able to obtain in this test 90% of the final qualification and 10% by the submission of the report including all the partial tasks proposed along the course. This test will be held during 2 hours on a date chosen by the Dean of the Faculty. This final examination will evaluate the competencies CE43 and CE44.

3. Extraordinary examination (June-July)

Consists of theoretical questions, problems and exercises. Students will be able to obtain in this test 90% of the final qualification and 10% by the submission of the report including all the partial tasks proposed along the course. This test will be held during 2 hours on a date chosen by the Dean of the Faculty. This final examination will evaluate the competencies CE43 and CE44.

Sources of information

Mohan, N., **Power electronics : converters, applications, and design**, John Wiley & Sons,

Barrado, A., **Problemas de electrónica de potencia**, Pearson Prentice Hall,

Rashid, M. H., **Electrónica de potencia: circuitos, dispositivos y aplicaciones**, Pearson Education,

Hart, D. W., **Electrónica de potencia**, Prentice-Hall,

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
