

SUBJECT TEACHING GUIDE

G1010 - Further Power Electronics

Degree in Industrial Electronic Engineering and Automatic Control Systems

Academic year 2023-2024

1. IDENTIFYING DATA			
Degree	Degree in Industrial Electronic Engineering and Automatic Control Systems	Type and Year	Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications		
Discipline	Subject Area: Electronic Technology Optional Module		
Course unit title and code	G1010 - Further Power Electronics		
Number of ECTS credits allocated	6	Term	Semester based (2)
Web			
Language of instruction	English	Mode of delivery	Face-to-face

Department	DPTO. TECNOLOGIA ELECTRONICA E INGENIERIA DE SISTEMAS Y AUTOMATICA		
Name of lecturer	FRANCISCO JAVIER AZCONDO SANCHEZ		
E-mail	javier.azcondo@unican.es		
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO PROFESORES (S3019)		
Other lecturers			

3.1 LEARNING OUTCOMES
- Students are trained in design oriented analysis of transformers and isolated DC / DC converters
- Students complete the training on modeling techniques for power converters operating in discontinuous conduction mode
- The students receive training in analysis and design of magnetic components and the isolated DC to DC power converter circuits.
- The students acquire knowledge on the principle of operation analysis and properties of resonant converters

4. OBJECTIVES

Provide the student with up to date knowledge of the isolation techniques and isolated converter topologies
Extend the capabilities of modeling and control design for power converters
Provide an overview of modern rectifiers and the standard that limit the line power factor and line harmonic content
Equip the students with modeling and control design capabilities of single and three-phase grid connected converters

6. COURSE ORGANIZATION

CONTENTS

1	<p>Furthering on Converter Dynamics and Control</p> <ul style="list-style-type: none"> - Input Filter Design - AC and DC Equivalent Circuit Modeling of the Discontinuous Conduction Mode - Current-mode Control
2	<ul style="list-style-type: none"> - Isolation Motivation - Filter inductor design constrains. Step by step design procedure. Multiple-winding magnetic design using the Kg method. Examples. Summary - Transformer design. Basic design constrains. Step by step design procedure using the Kgfe method. AC inductor design. Summary - Isolated DC - DC converter topologies Flyback Forward Push-Pull Half-Bridge Full-Bridge
3	<p>Modern Rectifiers and Power System Harmonics</p> <ul style="list-style-type: none"> - Power and Harmonic in Non-sinusoidal Systems - Line-Commutated Rectifiers - Pulse-width Modulated Rectifiers

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Work assignment, exercises and lab practices	Laboratory evaluation	No	Yes	40,00
Exam. The student receives an assignment that consist in developing a solution for a grid connected power conversion	Written exam	Yes	Yes	40,00
20% of the grading corresponds to test and assignments 40% of the grading corresponds to the lab development and 40% to the final exam where the results of the final assignment are presented in an oral presentation.	Others	No	No	20,00
TOTAL				100,00
Observations				
<p>The continuous assessment is not recoverable since it consists of evaluating the attention, participation and the degree of understanding of what is dealt with in the classes through exercises, small designs or questions and the interaction of the students during the development of teaching. The continuous evaluation also allows to identify the points to review in the tutorials.</p> <p>Students will develop analysis, modeling and design work in specific software and measurements in laboratory practices related to subject topics. The documentation to be evaluated is delivered in writing and in pdf files (models, analysis, simulation results).</p> <p>In the event that the health criteria make it necessary, the evaluation tests will be carried out following the mixed teaching format, face-to-face in the classroom and outside of it. In the most extreme case that the attendance of all students and teachers at the center is impossible or inconvenient, the evaluation tests will be developed using telematic means. In these cases, the content of the tests, being similar to the face-to-face case, may be totally or partially individualized for each student.</p> <p>In the case of a new health alert for COVID-19 make it impossible to carry out the evaluation in person, the remote evaluation of these same works, practical laboratory exercises and written tests is foreseen.</p>				
Observations for part-time students				
<p>Since 60% of the grading corresponds to activities developed during the regular classes and lab sessions the assessment criteria for part time student is the same as for other students</p>				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Christophe Basso Switch-Mode Power Supplies Spice Simulations and Practical Designs. Mc Graw Hill
R. W. Erickson, D. Maksimovic. Fundamentals of Power Electronics 3rd Edition Springer 2020
N. Mohan, T.M. Undeland, W.P. Robbins. Power Electronics: Converters, Applications and Design. John Wiley & Sons. 2003.
M. K. Kazimierczuk, D. Czarkowski, Resonant Power Converters 2nd Ed. New York: Wiley Interscience Publication, 2011.