Power Electronics

Academic Year: (2019 / 2020) **Review date: 10-05-2018**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: ZUMEL VAQUERO, PABLO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fundamentals of Electronic Engineering
Fundamentals of Electrical Engineering

OBJECTIVES

- Knowledge about electronic components, particularly those used in Power Electronics Systems
- Knowledge of the main circuit topologies used in the most representatives power converters (DC/DC, AC/DC, DC/AC, AC/AC)
- Knowledge of the circuits and characteristics of the most extended applications of Power Electronics
- Knowledge of electronics instrumentation, particularly the part applied in Power Electronics Systems

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Power Electronics.
    - 1.1. Fundamentals on Power Electronics.
    - 1.2. Typical applications.
2. Basic electric concepts.
    - 2.1. Passive components: resistor, inductor, capacitor.
    - 2.2. Average and rms of periodic signals.
    - 2.3. Fourier series of a periodic non-sinusoidal signal.
    - 2.4. Average and rms using Fourier series.
    - 2.5. Active, reactive and apparent power.
    - 2.6. Measuring the quality of a signal: ripple factor, power factor, harmonic distortion.
3. CA-CC conversion: rectifiers.
    - 3.1. Diodes
    - 3.2. Basic circuits with diodes.
    - 3.3. Non-controlled mono-phase rectifier.
        - 3.3.1. Resistor load.
        - 3.3.2. Capacitor filter.
        - 3.3.3. Inductor-capacitor filter.
    - 3.4. Controlled mono-phase rectifier.
        - 3.4.1. Resistor load.
        - 3.4.2. Highly inductive load.
        - 3.4.3. Free-wheeling diode.
    - 3.5. Controlled three-phase rectifier.
        - 3.5.1. Resistor load.
        - 3.5.2. Highly inductive load.
4. CC-CA conversion: inverters.
    - 4.1. Introduction and basic concepts.
    - 4.2. MOSFET and IGBT.
    - 4.3. Single phase, full bridge.
        - 4.3.1. Square wave.
        - 4.3.2. Phase shift control.
        - 4.3.3. Sinusoidal PWM.
    - 4.4. Three phase inverters.
        - 4.4.1. Square wave.
        - 4.4.2. Sinusoidal PWM.
5. CC-CC conversion.
    - 5.1. Introduction to power supplies.
    - 5.2. Analysis of dc-dc converters.

5.3. Topologies without galvanic isolation.
5.4. Topologies with galvanic isolation.

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures oriented to introduce Power Electronics concepts.
- Lectures oriented to problems resolution.
- Laboratory.
- Additional classes to solve doubts.

ASSESSMENT SYSTEM

- Laboratory (compulsory) (20%).
- Tests during the course (20%).
- Final test oriented to problems (60%, a minimum mark will we required).

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- A. BARRADO, A. LAZARO Problemas de Electrónica de Potencia, Pearson Prentice Hall, 2007
- D. W. HART Electrónica de Potencia, Prentice Hall, 2001
- M.H. RASHID Electrónica de Potencia: Circuitos, Dispositivos y Aplicaciones, Pearson Prentice-Hall, 2004
- N. MOHAN, T.M. UNDELAND, W.P. ROBBINS Power electronics, converters, applications and design, John Wiley & Sons, 2003
- R.W. ERICKSON, D. MAKSIMOVIC Fundamentals of Power Electronics, Kluwer Academic Publishers, 2001