Industrial Electronics

Academic Year: (2023 / 2024) **Review date: 24-04-2023**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: FERNANDEZ HERRERO, CRISTINA

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fundamentals of Electronic Engineering
Fundamentals of Electrical Engineering

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
COCIN1. Ability to draft, sign and develop projects in the area of industrial engineering for construction, renovation, repair, preservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, industrial plants and installations and automation and manufacturing processes.
COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.
COCIN5. Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar jobs.
CEP1. Capacity to design a system, component or process in the area of electrical engineering in compliance with required specifications.
CEP2. Knowledge and ability to apply computational and experimental tools for analysis and quantification of electrical engineering problems.
CEP3. Ability to design and carry out experiments to analyze and interpret data obtained.
ECRT7. Applied knowledge of electronic power.

By the end of this content area, students will be able to have:
RA1.3. Coherent knowledge of the branch of electrical engineering including some at the forefront of their branch in industrial electronics.
RA2.3. The ability to select and apply relevant analytic and modelling methods in industrial electronics.
RA3.2. An understanding of design methodologies for electric power conversion, and an ability to use them.
RA4.2. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA4.3. Workshop and laboratory skills.
RA5.2. The ability to combine theory and practice to solve electrical engineering problems.
RA5.3. An understanding of applicable techniques and methods in industrial electronics, and of their limitations.

OBJECTIVES

- Learn and use the most common electronic components in the field of Power Electronics.
- Learn and identify the most common topologies corresponding to three
- Identify the most characteristic circuits related with Power Electronics as well as the most common applications.

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.
    3.5. 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

- D. W. HART Power Electronics, Prentice Hall, 2001.
- 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.

ADDITIONAL BIBLIOGRAPHY

- F.F. MAZDA Electrónica de Potencia: Componentes, Circuitos y Aplicaciones, Paraninfo, 1995.
- S. MARTÍNEZ, J. GUALDA Electrónica de Potencia: Componentes, Topologías y Equipos, Thomson, 2006.