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: Electives ECTS Credits : 6.0

Year : 4 Semester :

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.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.
CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.
CG6. Applied knowledge of company organisation.
CG8. Knowledge and ability to apply quality principles and methods.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA3. Engineering Design: To be able to design industrial products that comply with the required specifications, collaborating with professionals in related technologies within multidisciplinary teams.
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.
RA6. Transversal Skills: To have the necessary skills for the practice of engineering in today's society.

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.