

60836 - Electric systems in industry

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	532 - Master's in Industrial Engineering
ECTS	6.0
Course	2
Period	Second semester
Subject Type	Optional
Module	---

1. Basic info

1.1. Recommendations to take this course

To take the subject of "Electrical Systems in the Industry", basic knowledge in mathematics, electromagnetism, electrical circuit analysis and electrical engineering in general are required.

1.2. Activities and key dates for the course

The subject is taught in the second semester of the second year of the Master in Industrial Engineering.

The start and end dates of the lectures, as well as the date of completion for laboratory works, delivery of final work, etc., will be made public at the start of the course, according to the timetables set by the School of Engineering.

2. Initiation

2.1. Learning outcomes that define the subject

The student, for achieving this subject, should demonstrate the following results...

He/she calculates, designs and integrates electrical systems in industrial processes and electromechanical systems

He/she knows the procedures for doing certifications, audits, inspections, tests and reports.

2.2. Introduction

The subject "Electrical Systems in the Industry" is offered as an optional subject in the field of "Electrical Systems" of the Master in Industrial Engineering, and it consists of 6 ECTS credits.

The course complements the training obtained in other subjects of the master, both mandatory and optional, so that the student has a complete overview of the application and design of electrical systems that allow integration and management of industrial processes with several machines. It describes electrical devices that allow the operation of electromechanical systems and special electrical machines. In short, electrical systems and components that are used in

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industry to control of both manufacturing processes and the quality assurance of the products obtained are presented.

The program of "Electrical Systems in the Industry" emphasizes especially on aspects related to the design and operation of electrical systems control of industrial plants using logic controllers, and facilities that most often students will find in their future professional practice.

Aspects related to quality control of processes and products are also addressed, describing the necessary measures to ensure the achievement of a production process controlled by an electrical system.

The design of the course aims to strengthen the application of knowledge in actual installations, so the practical activities play an important role in achieving learning outcomes.

3.Context and competences

3.1.Goals

The subject and its expected results meet the following approaches and objectives:

The design of the course is eminently practical and direct application of acquired knowledge for professional practice is important.

In the course "Electrical Systems in the Industry" it is intended that students:

− Acquire a clear idea of the different parts that make up an electrical system for controlling an industrial production process.

− Know the different ways of integrating electromechanical drives in the control systems.

− Meet the various electrical devices used to capture signals during the production process and product quality.

− Have a clear idea of the capabilities of electrical control systems, as well as in terms of logic programming of the process as regards to the information process management.

− Know the various large-scale electrical systems that allow communication between various devices of an industrial system.

− Know the necessary steps to ensure quality results in the product or controlled process.

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3.2.Context and meaning of the subject in the degree

The subject is taught in the optional block "Electrical Systems", which covers specific skills training of the Master in Industrial Engineering. It serves as an introduction for students to learn specific concepts of control production systems through the use of electrical devices.

3.3.Competences

By passing this subject, students will be able to...

1: Generic competences:

- Apply the acquired knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study (CB7).
- Communicate their conclusions and the knowledge and rationale underpinning to specialists and non-specialists in a clear and unambiguous way (CB9).

2: Transversal competences:

- Design, calculate and design products, processes, facilities and plants (CG2).

3: Specific competences:

- Have knowledge and skills to perform verification and control of facilities, processes and products (CM22).
- Have knowledge and skills to perform certifications, audits, inspections, tests and reports (CM23).

3.4.Importance of learning outcomes

The issues addressed in this course enable students to undertake projects of electrical systems process control at medium and large scale at all levels, from the equipment and electrical components that physically make up the installation through knowledge of the logic control intelligent control systems, to the junction with the technologies that enable the management of a quality control system. After passing the course, the student is competent to demonstrate fluency in industrial electrical control for both implementation tasks and management tasks.

4.Evaluation

The student must demonstrate that he/she has achieved the intended learning outcomes through the following evaluation activities:

Option 1: To encourage ongoing work of the student, it can be applied an overall assessment, by means of the continuous evaluation of the following activities:

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- Laboratory sessions (20% of the final mark): It is required to attend all the sessions. To pass the course is necessary to obtain a minimum score of 5 out of 10.
- Exercises (30% of the final mark): Throughout the semester, the resolution of practical exercises, similar to those solved in the contact sessions, will be proposed.
- Evaluation tests (20% of the final mark): several written tests (theory and practice) will be made during the course.
- Final work (30% of the final mark): A midcourse performing work will be proposed, in which the student will demonstrate the assimilation and integration of all the concepts presented in the course. The student will present the work at the end of the semester.

Option 2: Students who do not follow the assessment of Option 1 are entitled to an alternative assessment, consisting of:

- Written exam (50% of the final mark): written test, comprising theory and practice of the subject matters.
- Laboratory exam (50% of the final mark).

To pass the course following this alternative assessment, it is necessary to obtain a minimum score of 5 out of 10 in each of the two exams.

5. Activities and resources

5.1. General methodological presentation

The learning process is based on the following:

Lectures, exercises classes and laboratory lessons are taught, with active student participation throughout them.

• In the lectures and exercise works, the concepts of the contents of the subject, with practical examples and real industrial references, will be presented.

• Laboratory activities are developed in small groups, where students will perform the assembly/integration of various real devices used in electrical control systems.

5.2. Learning activities

The program that is offered to the student for achieving the learning outcomes, includes the following activities... 1: Classroom lessons. The explanation of theoretical contents, related to the contents of the subject, will be made. Different written material prepared by teachers will be available on the educational web platform (<http://moodle2.unizar.es/>), to help the lesson understanding (lecture notes and lecture slides). In addition, practical exercises related to the theoretical presentations will be developed.

2: Laboratory lessons. The students will have practical scripts, provided in advance, with a description of the assembly and the steps for the activity development. For a good use of each session, the student needs to go to laboratory lessons with the scripts previously read.

3: Final work/case. In the middle of the course, the resolution of a final case will be proposed. This work will cover comprehensively aspects of design and control of a real situation of an electrical installation for industrial control. The student must present the work at the end of the semester. 4: Individual study. These hours of personal work are distributed along the 15 weeks of the course. The ongoing work of the student will be promoted, by the distribution of the different learning activities throughout the semester.

It is included in this section preliminary work required in preparation of laboratory lessons. It is very important that

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students develop personal work. Periodically, students develop exercises and cases will be proposed; some of them will be solved in the lectures. 5: Tutoring meetings. The student (freely) can ask the teacher to solve doubts related to the subject. For this, the student has a tutoring business hours. 6: Assessment exams. The evaluation is also a learning tool with which the student checks the degree of understanding and assimilation of knowledge and skills achieved. Because of this reason, various assessment tests distributed along the course will be done.

5.3.Program

The content of the course is divided into two main blocks, in which concepts of "Industrial Quality and Safety" and "Control of Electrical Systems" are developed. So, the program is distributed as follows. Part 1: Industrial Quality and Safety.

Unit 1: Introduction to quality and industrial safety.

Unit 2: Organizations.

Unit 3: Directives and standards. Technical instructions.

Unit 4: Electrical safety.

Unit 5: Electromagnetic compatibility.

Unit 6: Machinery Safety.

Part 2: Control of Electrical Systems.

Unit 1: Introduction to control of electrical systems.

Unit 2: Control by using programmable controllers.

Unit 3: Monitoring of electrical systems in the industry.

Unit 4: Communications in the industrial environment.

For the 15 hours of laboratory works, they will be held through five sessions, with the following program:

Practice 1: Measurement of dielectric strength and insulation resistance of electrical equipment.

Practice 2: Tests for characterization of electrical cables.

Practice 3: Control of an installation with PLC.

Practice 4: Control system with frequency converter for temperature regulation.

Practice 5: Control and supervision system for electrical power management.

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5.4.Planning and scheduling

The lessons in the classroom and laboratory (4h / week) will serve to present the theoretical and practical contents of the subject, as well as for solving practical cases. The contents corresponding to the two thematic blocks will be simultaneously presented. Five laboratory sessions will be made, distributed along the semester (within the same 4h per week basis). The two first sessions will be related to Industrial Quality and Safety (part 1), and the three last ones will be related to Control of Electrical Systems (part 2). Several theoretical and practical written exams will be made distributed along the semester. Students will be also asked to solve a practical case, as a final work of the subject.

The final case deadline and other dates for tests and laboratory sessions will be reported at the beginning of the course.

5.5.Bibliography and recommended resources

All the information will be available at the web page of the subject in the Moodle platform