Universidad Zaragoza

**Academic Year/course: 2022/23**

# 29839 - Electronic Design Laboratory

## Syllabus Information

**Academic Year:** 2022/23
**Subject:** 29839 - Electronic Design Laboratory
**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura
**Degree:** 440 - Bachelor's Degree in Electronic and Automatic Engineering
**ECTS:** 6.0
**Year:** 4
**Semester:** First semester
**Subject Type:** Optional
**Module:**

# 1. General information

## 1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:
- It is instructed on strategies and tools to find and select electronic components. The interpretation and use of technical information provided by electronics manufacturers and distributors is practiced.
- Electronic circuits are designed, applying design methodologies from specification to debugging.
- The assembly of real electronic systems with previously analyzed and selected components is addressed to achieve circuit tuning skills.
- Software tools are used to introduce diagrams and design of printed circuit boards.
- A prototype is built in the laboratory, developing analysis, problem solving and set-up skills.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDG, of the 2030 Agenda ( https://www.un.org/sustainabledevelopment/es/) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provides training and competence to the student to contribute to a certain extent to their achievement:

- Goal 3: Ensure healthy lives and promote well-being for all at all ages.
    - Target 3.9 By 2030, substantially reduce the number of deaths and illnesses caused by hazardous chemicals and air, water and soil pollution
- Goal 7: Ensure access to affordable, safe, sustainable and modern energy for all
    - Target 7.2 By 2030, significantly increase the share of renewable energy in the energy mix
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all "
    - Target 8.2 Achieve higher levels of economic productivity through diversification, technological modernization and innovation, including by focusing on high value-added and labor-intensive sectors
    - Target 8.4 Progressively improve, by 2030, the efficient production and consumption of world resources and seek to decouple economic growth from environmental degradation, in accordance with the Ten-Year Framework of Programs on Sustainable Consumption and Production patterns, starting with the developed countries
- Goal 9. Industry, innovation and infrastructures
    - Target 9.5 Increase scientific research and improve the technological capacity of industrial sectors in all countries, particularly developing countries, including by fostering innovation and significantly increasing, by 2030, the number of people working in research and development per million inhabitants and the spending of the public and private sectors in research and development
- Goal 13: Take urgent action to combat climate change and its effects
    - Target 13.3 Improve education, awareness, and human and institutional capacity regarding climate change mitigation, adaptation, reduction of its effects, and early warning

## 1.2. Context and importance of this course in the degree

This optional subject is within the Electronic Systems subject of the degree. In it, everything learned in electronic subjects is put into practice through the completion of an electronic project (project-based learning teaching methodology).

Special emphasis is placed on three fundamental aspects for the professional of electronic engineering, such as the study of technologies, the investigation of real electronic components and their selection, the design of printed circuit boards and the assembly and debugging of prototypes in the laboratory.

On the other hand, and as explained in various points of this guide, the methodology used causes students to acquire professionalizing transversal skills of great value to an engineer.

The topics related to project management and applicable regulations are a direct subject of the compulsory subject Project Office, so they will not be addressed here.

### 1.3. Recommendations to take this course

To take this course, the student must have sufficient knowledge of Fundamentals of Electronics and Programmable Electronic Systems.

The study and continued work, from the first day of the course, are essential to overcome the subject with the maximum advantage.

## 2. Learning goals

### 2.1. Competences

**Basic competences**

1.- That students know how to apply their knowledge to their work or vocation in a professional way and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

2.- That students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience

3.- That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

**Specific competences**

1. Ability to design analog, digital and power electronic systems.

**Cross-cutting competences**

1.- Ability to combine basic and specialized knowledge of Engineering to generate innovative and competitive proposals in professional activity.

2.- Ability to solve problems and make decisions with initiative, creativity and critical reasoning

3.- Ability to communicate and transmit knowledge, abilities and skills in Spanish

4.- Ability to conceive, design and develop Engineering projects

### 2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

- Design electronic circuits and systems using computer aided design tools
- Properly selects electronic components, including the most suitable packaging
- Design printed circuit boards
- Build and debug electronic prototypes in the lab

### 2.3. Importance of learning goals

Through the ?learning by doing? strategy, the described skills related to electronic design, assembly, verification and tuning of prototypes are developed, using electronic design computer tools and building real assemblies.

On the other hand, skills and attitudes of a professional nature are developed, by collaborating with the Degree in Industrial Design Engineering and Product Development. Teamwork is divided into two levels: A first group made up of electronics students and, encompassing it, a team made up of the electronics group and the designers group. The latter causes interaction between training people and different work procedures, simulating the real situation in the industry, where professionals of very different backgrounds have to collaborate to achieve common goals. The skills thus achieved are of great importance to an engineering professional and are highly valued by employers.

## 3. Assessment (1st and 2nd call)

### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that they have achieved the expected learning outcomes through the following assessment activities

Given the 100% practical nature of the subject, a continuous evaluation is proposed, the result of which will be the final grade in the first call (according to the exceptional condition that is stated in article 9.4 of the Regulation of Learning Assessment Standards and which was authorized for this subject by the UZ).

The subject is based on the teaching methodology of project-based learning, which will materialize in the conception, development and assembly of an electronic project of complexity and size appropriate to the extension of the subject. It is specified in a series of evaluable activities:

CONTINUOUS EVALUATION DURING THE TEACHING PERIOD

1. "express" project: 30%.

In the first weeks of the course, in preparation for the subject project and to articulate the work teams, a small electronic project of limited extension will be carried out. This first approach is used to practice electronic design from a realistic perspective (selection of components, tuning of circuits, implementation on printed circuit boards) and to introduce design tools. The scope of operation of the prototype, the documentation, the oral presentation and the effectiveness of teamwork will be assessed.

2 Laboratory work: 10%.

A project will be developed continuously throughout the semester. This item is valued by direct observation of the teachers, the intensity, consistency and quality of the work in the laboratory. of this work. In addition, students will be required to make very brief reports that will take the form of deliverables or presentations.

3 Subject project: 60%.

This item values the work done to achieve the subject project as follows:

The quality of the solution, the degree of finish and the success in the operation
A report that reflects all the work done for the project. It will be presented before the official call, on the date indicated by the teachers. Each group will have to present a report describing the project and the work carried out throughout its implementation, from the initial investigations, proposed circuits, design decisions and trials, to the set-up. The adequacy of all these aspects will be taken into account and a global assessment of the quality of the project will be made.
Oral presentation to teachers and classmates, using computer tools dedicated to presentations. The support of the presentation (pdf, ppt or other), the quality of the exhibition, efficiency in communication and adaptation to the work presented will be assessed.
Some of the evaluation elements will be shared with the students of industrial design, both parts of the team being co-responsible for the success of the finished product and the associated qualifications.

IN THE 2ND OFFICIAL CALL

1 Subject work 60%. Consisting of an electronic design with real components, its corresponding simulation, printed circuit board design and final configuration. As support, the tools and informative documents of the subject will be used and will appear in the digital teaching ring. The student must generate a report and prepare a presentation (both in accordance with the provisions of Moodle) that will take place on the day of the test.

2 Written exam 40%. Carried out in a computer room. Theoretical-practical exam in which the learning results will be evaluated.

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

This is a fully practical course in which the students develop projects at the laboratory using the Project-Based Learning methodology. The students have to follow all the stages of a project from the conception to the constructions of a prototype. By means of the methodology, all the learning objectives are reached in this process. Furthermore, as this methodology is

applied to teams, students can reach social competences related to the team working, collaborative learning and communication skills. Teams can be augmented by the participation of students of Industrial Design increasing those competences to a more professional level thanks to the interdisciplinary aspect of the collaboration.

## 4.2. Learning tasks

The course includes the following learning tasks:

- The activities of the course lean on the learning methodology called Project-Based Learning applied to teams.
- Some theoretical sessions and workshops will be held about specific design items.
- There will be two projects to develop. The first one, smaller, acts as training to address the main project. The students practice the selection of electronic components, learn the use of CAD tools and develop mounting skills.
- The main objective is to develop a whole project from the initial conception to the construction of a working prototype.
- The teams will program working meetings at all the stages of the work and will report the lecturers about the advances of the project.
- Eventually, the project will be shared with teams of students of Industrial Design. This entails a close collaboration intended to develop interdisciplinary team working skills by carrying out an industrial project with an electronic system inside.
- The assessment is considered an important point in the learning process. Teams will hold an oral presentation in front of the lecturers and the other teams, and this will be an enriching occasion to learn from each other.

## 4.3. Syllabus

The course will address the following topics:

- Methodology and planning.
- Electronic components and technologies: research and selection.
- Specification of the electronic Project.
- Electronic design using CAD programs, design of a printed circuit board, prototyping and tuning.
- Documentation and oral presentation.

## 4.4. Course planning and calendar

All the sessions will be hold in an electronic laboratory. The schedule and timetable of all activities including assessment, will obey the directions of the University and the School.

## 4.5. Bibliography and recommended resources

Moodle tool will be used to structure the activities of the subject, as a deposit of all the important documents, as well as a channel of information with the students.

The main source of information is the technical information (datasheets) that is mainly supplied by manufacturers and distributors. This information will be available in the classroom through an internet connection.