Universidad Zaragoza

Year : 2020/21

30121 - Basic principles of electronics

Syllabus Information

Academic Year: 2020/21
Subject: 30121 - Basic principles of electronics
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
179 - Centro Universitario de la Defensa - Zaragoza
Degree: 457 - Bachelor's Degree in Industrial Organisational Engineering
563 - Bachelor's Degree in Industrial Organisational Engineering
425 - Bachelor's Degree in Industrial Organisational Engineering
ECTS: 6.0
Year: 3
Semester: First semester
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

The main goal of this subject is to give to the student the basic fundamentals of electronic technology. Therefore, one of the topics will be the study of digital and analog electronic components, how they work, how to design and which are the main uses of these devices. We also work in methodological issues to the analysis and design of simple electronic circuits with the help of simulation tools and lab instrumentation.

1.2.Context and importance of this course in the degree

Principles of electronics is a common subject in all the industrial engineering degrees and the knowledge of this subject is key to the engineering curriculum.

More specifically, this subject belongs to ordinary training unit to address, apart from generic competences, knowledge of fundamentals of electronics.

On the degree in Industrial Organisational Engineering, specialization in defence, the principles of electronics subject prepare students in the necessary competence to address the optative modules of radar systems and missiles and communication systems.

1.3.Recommendations to take this course

In order to be successful in this subject, the student should have taken or should be taking the subject of Electrical engineering, and it is recommended to have taken Physics and Chemistry.

2.Learning goals

2.1.Competences

General competences:

- Ability to solve problems and take decisions with initiative, creativity and critical reasoning.
- Ability to communicate knowledge and skills in Spanish.
- Ability to use techniques, skills and tools necessary to practise engineering.

Specific competences:

- Knowledge of the fundamentals of electronics.

2.2.Learning goals

1. Identifies the applications and functions of electronics in Engineering.
2. Recognises basic electronic components and devices used for the different electronic functions.
3. Uses basic techniques for analyses of analog and digital electronic circuits.

4. Is able to design analog and digital electronic circuits at block diagram level.
5. Manages the tools of a basic electronics laboratory and uses electronic simulation tools.

2.3.Importance of learning goals

When students reach the learning goals of this subject, they will be able to understand the fundamentals of how to work with several electronic devices and the equations that rule their behaviour, as well as, the basis of electronic instrumentation. Experimental practices in the laboratory are mandatory for engineering graduate students and they allow them to reinforce the theory with practical sessions.

For defence, this subject is the fundament for some optional modules.

3.Assessment (1st and 2nd call)

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

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1. Practical tasks (30%). These tasks include laboratory practices and problem-solving. At the beginning of each laboratory practices, the students should submit a preliminary study. Its quality will be considered in the evaluation since they are essential to perform the practices in an agile way. A final report should be submitted at the end of each practice. To pass the subject the student must obtain a final note in the laboratory practices equal to or greater than 5.
2. A theoretical-practical test (70%) in which some questions and/or problems of the engineering area are proposed to be solved. Its typology and complexity level will be similar to those questions and problems are seen in class. The test will be evaluated in terms of the quality and clarity of the solving strategy, of the concepts used to solve the problems, of the absence of errors in the development and solution, and of the correct use of terminology and notation. In each of the theoretical and practically written tests, students must obtain a note equal to or greater than 5 to pass the subject.

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The evaluation of this subject depends on three factors: exam, lab sessions and activities:

- The exams will consist on theoretical questions and problems. One or more exams will be carried out during the semester, in addition to the final exams of first and second call. In first call, the global exam mark will be calculated taken into account the marks of the exams carried out during the semester (50%) and the mark of the final exam (50%). In second call, the global exam mark will be the mark obtained in the final exam.
- Before every lab session, a previous study will be carried out by students. During lab sessions, a report describing the obtained results and its analysis will be performed. The documents considered by the teachers, individual tests and a continuous assessment system will be taken into account to mark the lab practice.
- Activities will mainly consist on numerical problems and multiple-choice questions through Moodle platform.

In order to pass this subject, two requirements must be fulfilled:

- The student must perform all lab sessions and must obtain a global mark equal or superior to 5. If not, the student must demonstrate individually its abilities to characterize circuits with basic instrumentation.
- The global mark of the exam must be equal or superior to 5.

If the aforementioned requirements are fulfilled, the final mark of the subject will be the best of the two defined next:

- 60% global exam mark, 20% lab mark, 20% activities mark.
- 80% global exam mark, 20% lab mark.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

If this teaching could not be done in person for health reasons, it would be done telematically.

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There is a strong interaction between teacher and student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject Automatic Foundation is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or

resolution of questions and laboratory work, at the same time supported by other activities

The organization of teaching will be carried out using the following steps:

- **Lectures**: Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.
- **Practical Classes**: The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.
- **Laboratory Workshop**: The lecture group is divided up into various groups, according to the number of registered students, but never with more than 20 students, in order to make up smaller sized groups.
- **Individual Tutorials**: Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.

Defence

The contents of the subject will be presented using an active methodology based on problem-based learning. The methodology of the proposed activities is designed for encouraging the autonomous work of the student. During laboratory sessions, students will learn to recognize the basic electronic compounds and devices and to handle the basic instrumentation. Electronic simulators will be also introduced to reinforce the techniques of analysis of electronic circuits.

4.2.Learning tasks

The course includes the following learning tasks:

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Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

Face-to-face generic activities:

- **Theory Classes**: The theoretical concepts of the subject are explained and illustrative examples are developed as a support to the theory when necessary.
- **Practice Sessions**: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- **Laboratory Workshop**: This work is tutored by a teacher, in groups of no more than 20 students.

Generic non-class activities:

- Study and understanding of the theory taught in the lectures.
- Understanding and assimilation of the problems and practical cases solved in the practical classes.
- Preparation of seminars, solutions to proposed problems, etc.
- Preparation of laboratory workshops, preparation of summaries and reports.
- Preparation of the written tests for continuous assessment and final exams.

The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the trimester, in other words, 10 hours per week for 15 weeks of class.

A summary of a weekly timetable guide can be seen in the following table. These figures are obtained from the subject file in the Accreditation Report of the degree, taking into account the level of experimentation considered for the said subject is moderate.

Activity	Hours per week
Lectures	3
Laboratory workshop	1
Other activities	6

Nevertheless, the previous table can be shown in greater detail, taking into account the following overall distribution:

- 44 hours of lectures, with 50% theoretical demonstration and 50% solving type problems.
- 12 hours of laboratory workshop, in 1 or 2-hour sessions.
- 4 hours of written assessment tests, one hour per test.
- 40 hours of teamwork divided up over the 15 weeks of the semester.
- 50 hours of personal study, divided up over the 15 weeks of the semester.

Defence

Theoretical classes will consist of the explanation of the contents by the teacher encouraging the involvement of students.

Practical classes will consist of problem resolution by applying the techniques of circuit analysis.

Lab sessions will be carried out in order to reinforce some theoretical contents explained in class. During these sessions, the students will get familiar with basic electronic devices and the use of measurement instrumentation of an electronics laboratory.

Activities will be proposed through the platform Moodle. Thus, students can carry out constant and autonomous work and teachers can visualize the performance of students.

Electronic simulators will be used for studying the behaviour of circuits which will be implemented in lab sessions. Furthermore, that tools can be employed to facilitate the understanding of the behaviour of proposed circuits to the students.

The slides and a collection of problems for each lesson, besides the material related to the lab sessions, circuit simulator, etc., will be available at Moodle (https://moodle2.unizar.es/add/). This platform will be also used to deliver and evaluate the proposed activities along the course. Finally, students can apply individual tutorials to the teachers through the platform YouCanBookMe https://youcanbook.me/.

4.3.Syllabus

The course will address the following topics:

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- Introduction
- The Transistor
- Operational amplifiers
- Combinational systems
- Sequential systems

A detailed guide will be available at the beginning of the course in ADD: http://moodle2.unizar.es/add.

Materials

The different teaching materials will be provided in ADD: http://moodle2.unizar.es/add.

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The content of the course is divided into the following Topic s:

Topic 1. Introduction to Electronics

- Electrical signals: Time and frequency domain
- Analog / Digital Electronics: AD and DA conversion
- Applications: Signal processing, telecommunications, control and power electronics

Topic 2. Semiconductors

- Insulators/conductors
- Covalent band model
- Band theory
- Conductivity

Topic 3. Diodes

- PN junction
- Types of diodes
- Applications of diodes
- Large signal models

Topic 4. Operational amplifier

- Ideal OA
- Comparator circuits
- Amplifier circuits

Topic 5. Transistors

- BJT
- MOSFET
- Biasing
- Small signal models
- Amplifier circuits
- Switch circuits

Topic 6. Fundamentals of digital electronics

- Binary codes
- Binary arithmetic
- Boolean Algebra
- Logic gates
- Logic functions
- Simplification of logic functions

Topic 7. Digital systems

- Introduction
- Combinational systems
- Latches and flip-flops
- Sequential systems

4.4.Course planning and calendar

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Class hall sessions & work presentations timetable will be found in https://moodle2.unizar.es/add/

The dates of the final exams will be those that are officially published at http://www.eupla.es/secretaria/academica/examenes.html.

The written assessment tests will be related to the following topics:

- **Test 1**: Topic 1, 2, 3
- **Test 2**: Topic 4, 5

At the end of every topic, the student can find some reinforce exercises in order to guide him in their personal homework.

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The course's content is distributed in approximately 4 hours per week of classroom activities, which include lectures, problem classes and laboratory work, and 6 hours per week of non-contact activities, including self-study and carrying out the proposed activities and the required previous study of the laboratory practices.

Class and lab sessions timetable, as well as the official dates for exams, are established by the University Centre for the Defence and published in the website: cud.unizar.es.

4.5.Bibliography and recommended resources

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Bibliography available here: http://biblos.unizar.es/br/br_citas.php?codigo=30121&year=2020