

30121 - Basic principles of electronics

Información del Plan Docente

Academic Year	2017/18
Faculty / School	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	425 - Bachelor's Degree in Industrial Organisational Engineering 457 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Year	3
Semester	Half-yearly
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

The subject of Electronics principles develops the fundamentals in technological electronics in order to know the basic principles of electronic devices that are embedded in nowadays technology.

1.2.Recommendations to take this course

In order to be successful in this subject the student should have taken the subject Electrical engineering, and its recommended to have Physics and Chemical.

1.3.Context and importance of this course in the degree

Electronic foundations is a common subject in all the industrial engineering degrees and the knowledge of this subject is key to the engineering curricula.

More specifically, this subject belongs to ordinary training unit to address, apart from generic competencies, knowledges of electronic foundations.

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

1.4.Activities and key dates

The activities of this subject and its temporal schedule depend on the academic organization proposed by the faculty (Centro Universitario de la Defensa o Escuela Politécnica de la Almunia) and you can read it in section 5, Methodology, learning tasks, syllabus and resources.

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2. Learning goals

2.1. 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 the block level.
5. Manages the tools of a basic electronics laboratory and use electronic simulation tools.

2.2. Importance of learning goals

When students reach those competences they will be able to understand the foundations of how to work with several electronic devices and the equations that rule their behavior. They also need to understand the basis of instrumentation electronics. They need to have strong skills in lab equipment which allows reinforcing the theory with practical skills

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

3. Aims of the course and competences

3.1. Aims of the course

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

3.2. Competences

General competencies:

- Have the ability to solve problems with initiative, take decisions, creativity and critical reasoning
- Have the ability to communicate and transmit knowledge, abilities and skills in the field of the Spanish language.
- Have the capability to use technics, skills and tools of engineering in order to be an engineer.

Specific competencies:

- Knowledge in electronics foundations.

4. Assessment (1st and 2nd call)

4.1. 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 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 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 or greater than 5

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to pass the subject.

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

- The exam will consist on theoretical questions and problems.
- 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 previous study, the report and individual test will be taken into account to mark the lab practice.
- Deliverable activities will consist on numerical problems 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 final mark equal or superior to 5. If not, the student must demonstrate its abilities to characterize circuits with basic instrumentation individually.
- The global mark of exam must be equal or superior to 5.

The final mark of the subject will be the best of the two defined next:

- 70% exam mark, 20% lab mark, 10% activities mark.
- 80% exam mark, 20% lab mark.

5. Methodology, learning tasks, syllabus and resources

5.1. Methodological overview

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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:

- **Theory Classes** : 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.

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The contents of the subject will be presented using an active methodology based on problem-based learning. The evaluation of the involved 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.

5.2.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.
- **Practical Classes** : 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

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Other activities	6
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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.

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Theoretical classes will consist on the explanation of the contents by the teacher encouraging the involvement of students. Practical classes will consist on problem resolution by applying the techniques of circuit analysis.

As an exception, the 6th lesson (Fundamentals of Digital Electronics) will be dealt with by the students on their own, having the support of specific material, a collection of problems with solution and recommended bibliography.

Activities will be proposed through the platform Moodle. Thus, students can carry out a 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 recommended material and a collection of problems for each lesson, besides the material related to the lab sessions, will be available at Moodle (<http://moodle.unizar.es>) at the beginning of the course. 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/>.

5.3.Syllabus

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- Semiconductors. The diode
- The bipolar transistor
- The unipolar transistor
- Operational amplifiers
- Digital systems (combinational & sequential)

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

Materials

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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 lessons:

Lesson 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

Lesson 2. Semiconductors

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

Lesson 3. Diodes

- PN junction
- Types of diodes
- Large signal models
- Applications of diodes: Rectifier, Clipper, Voltage regulator, Optoelectronics

Lesson 4. Transistors

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

Lesson 5. Operational amplifier

- Ideal OA
- Comparator circuits
- Amplifier circuits

Lesson 6. Fundamentals of digital electronics

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

Lesson 7. Combinational systems

- Comparator
- Adder / subtractor

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- Encoder / Decoder
- Code converter
- Multiplexer / demultiplexer
- ROM Memory

Lesson 8. Sequential systems

- Latches and flip-flops
- Registers
- Counters
- RAM Memory

5.4.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, completion of deliverable activities and the required previous study of the laboratory practices.

Three laboratory sessions are proposed:

- Applications of diodes. Characterization of rectifiers and clippers
- Amplifiers. Characterizations of amplifiers based on operational amplifier (OA) or common-emitter topology
- Applications of OAs. Characterization of active circuits based on OAs

Additional information can be found through the website of the University Centre for the Defence: <http://cud.unizar.es>.

5.5.Bibliography and recommended resources

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