# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 34928 |
| **Name** | Electronic technology |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2023 - 2024 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1404 - Degree in Industrial Electronic Engineering | School of Engineering | 2 | Second term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 1404 - Degree in Industrial Electronic Engineering | 11 - Foundations of electrotechnics and electronics | Obligatory |

**Coordination**

| Name | Department |
|---|---|
| NAVARRO ANTON, ASUNCION EDITH | 242 - Electronic Engineering |

# SUMMARY

This 6 ECTS subject belongs to the Basics of Electrical and Electronics matter, which is included within the block Common Industrial Branch, which is given in the Industrial Electronics Degree in the second semester of the second year. The workload for the student is 150 hours over the semester: 60 hours of class lessons and 90 hours are self-organised. The Electronic Technology course share its contents with the Electronic Principles course which is given in the second semester of the first year in the Industrial Electronics Degree.

As expressed in the contents of the degree module: "is the first student contact with the principles and basis of analog electronics. Will analyse the basic concepts of electronic components and circuits and general techniques for analysing them in both time domain and in sinusoidal steady state. The diode, transistor will be described based on semiconductors physics and also its main applications. Finally, will be presented the basic principles of magnetic circuits leading to the transformer as the basis for other electrical machines. It will be explained the basic phenomena of electromechanical energy conversion and the key issues common to rotating machines and it will be explained its functions and construction aspects."

As a part of the matter Fundamentals of Electrical and Electronics, the Electronic Technology course will be responsible of the contents: semiconductor diode, Bipolar Transistor (BJT), Field Effect Transistor (MOSFET) and its applications.

Apart from purely theoretical contents, the course will provide the student with general knowledge necessary for solving engineering problems. The problem-solving skills will be acquired in the problem sessions of the course, where students must find solutions to problems that requires obtaining several solutions prior to the final result.

On the skills that are required for any engineer, the subject provides the knowledge required for assembly basic circuits on protoboards. Providing students with the skills: component search, schematic circuit understanding, circuits assembly and measurement using laboratory instrumentation, data representation on tables and graphs, and finally the understanding of these data once obtained.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

The backgrounds needed to follow the subject are those acquired in the subjects of mathematics taught in first course and the subject Electronic Principles.

## OUTCOMES

### 1404 - Degree in Industrial Electronic Engineering

- CG3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.
- CG4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering (with specific industrial electronics technology).
- CG5 - Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and analogous work.
- CG6 - Ability to deal with specifications, regulations and mandatory standards.
- CG11 - Knowledge, understanding and ability to apply the necessary legislation for practising professionally as a qualified industrial engineer.
- CG21 - Knowledge and use of the fundamentals of circuit theory and electric machines.
- CG22 - Knowledge of the fundamentals of electronics.

## LEARNING OUTCOMES

The main learning result understands the macroscopic characteristics and performance of electronic devices through knowledge of their behaviour at the microscopic level. When a student of the Grade uses an electronic device, he will know its limitations and nonlinear characteristics depending on their manufacture. (CG3, CG5, CG6 and CG22)

Other results obtained by the student's learning of this subject are the following:

- Identify and describe the basic operating modes of electronic devices (CG3, CG4, CG5, CG6, CG11, CG21 and CG22)
- Understand the operation of basic electronic devices and their features, applications and limitations. (CG3, CG4, CG5, CG6, CG11, CG21 and CG22)
- Linearize the different devices and dapply its equivalent circuit in order to understand the circuit. (CG3, CG4, CG5, CG6, CG11, CG21 and CG22)
- Be able to identify electronic components and circuits and implement basic designs. (CG3, CG4, CG5, CG6, CG11, CG21 and CG22)

After studding the subject Electronics Technology, the student must have acquired a number of social skills, these social skills can be classified as instrumental, personal and systemic.

**Instrumental**

- Ability to analyze an engineering problem for optimal resolution.
- Ability to organize and plan the subject like a project.
- Appropriate use of scientific and technical terms.
- Ability to write in a formal language understandable to other engineers.
- Ability to manage time spent for studying.
- Decision making.

**Personal**

- Ability to work in a multidisciplinary team.
- Ability to work in an international context.
- Ability to communicate with experts in other areas.
- Skills in interpersonal relationships.
- Critical reasoning.
- Ethical commitment.

**Systemic**

- Ability to apply knowledge acquired in the course.
- Ability to learn and work independently.
- Adapting to new situations.
- Creativity. Ability to explore new solutions.
- Leadership. Initiative and enterprising spirit.

Capacity of personal improvement in problem solving.

## DESCRIPTION OF CONTENTS

### 1. The diode

Chapter 1. The diode.
1.1. Diode characteristic.
1.2. Load line analysis.
1.3. The diode model: ideal and real. Small signal.
1.4. Zener diodes.
1.5. Data sheets.
1.6. Applicatons.

### 2. The bipolar transistor

Chapter 2. The bipolar transistor.
2.1. Types of transistors. Basic operation of the bipolar transistor.
2.2. Common emitter load line analysis.
2.3. Data sheet.
2.4. Large-signal transistor models.
2.5. Bias circuits.
2.6. Small-signal circuits.
2.7. Class A amplifier
2.8. Class AB amplifiers: push-pull.

### 3. The unipolar transistor: MOS

Chapter 3. Unipolar transistor: MOS.
3.2. Basic operation of the MOSFET transistor.
3.3. Load line analysis
3.4. Bias circuits.
3.5. Data sheet.
3.6. Amplifier circuits
3.7. Small-signal model

### 4. Lab work

Experiment 1. Junction diode. IV characteristic and its applications. (two sessions)
Experiment 2. BJT output characteristic in common emitter configuration.
Experiment 3. Push-pull amplifier with common emitter driver and direct connection.
Experiment 4 The MOSFET transistor.
Experiment 5. MOSFET transistor amplifier circuits.
Experiment 6. Exam.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theory classes | 25,00 | 100 |
| Laboratory practices | 20,00 | 100 |
| Classroom practices | 15,00 | 100 |
| Attendance at events and external activities | 1,00 | 0 |
| Development of group work | 10,00 | 0 |
| Development of individual work | 10,00 | 0 |
| Preparation of evaluation activities | 40,00 | 0 |
| Preparing lectures | 9,00 | 0 |
| Preparation of practical classes and problem | 20,00 | 0 |
| **TOTAL** | **150,00** | |

## TEACHING METHODOLOGY

**TECHNICAL LECTURES.**

The technical lectures are master classes. During the master class the lecturer will ask some questions to the students to monitor the student progress in its self-organised work previous to each class. The master class will be supported by animated slides to improve the understanding of the abstract concepts involved in the devices junctions. All the support material used in the lectures (slides, papers, web links, bibliography, etc), will be available for the student in “Aula Virtual”. Aula Virtual is an application developed by the University of Valencia that make easy and direct the access to the different teaching and administrative resources. Competencies CG3, CG4, CG5, CG6, CG11,CG21 and CG22 are worked.

**PROBLEM CLASSES.**

The problem classes will be in the classroom with a smaller group of students that in the technical lectures. In the problem classes some of the more significant problems that appear in the Problem Sheet will be solved. The problems will be solved in the backboard by the professor or by the students. As in the technical lectures, all the teaching resources will be available in Aula Virtual. Competencies CG3, CG4, CG5, CG6, CG11, CG21 and CG22 are worked.

**LABORATORY SESSIONS**

The laboratory sessions will be held in the laboratories of the ETSE. During the first half an hour of each laboratory session, the professor will evaluate the student self-organised work about the contents of the scheduled session. This evaluation will be done through some short questions, time scheduled of 15 minutes, or through some individual questions to the students in those groups with fewer students. Competencies CG3, CG4, CG5, CG6, CG11, CG21 and CG22 are worked.

**TUTORIALS**

The students have a tutorial timetable to solve problems, doubts, work orientation, etc. The tutorial timetable is set at the beginning of the academic course. Competencies CG3, CG4, CG5, CG6, CG11, CG21 and CG22 are worked.

## EVALUATION

**THEORY-PROBLEMS EVALUATION.**

The theory -problems part can be overcome by two methods, or continuous assessment or a final exam at the end of the semester.

- Continuous assessment system. At the end of each chapter there will be a multiple choice test with only theory questions (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). The multiple choice exams will have a 60% on the total rate. The grade of each test will be added to the next to calculate the final grade. No make-up tests are made. If you have chosen the continuous assessment, on the official exam date you will have only a problems exam (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). This exam has a 40% rate on the total mark. To average theory (multiple choice test) and problems the mark must be at least 5 in multiple choice test and 5 in problems test.

There will be a problems test (diodes only) at the end of the first unit of one hour (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). If the mark obtained in this test is greater than 5, until 2 points will be added to the mark obtained in the final problems test (to be held on the official date), if the mark obtained in the final problems test is greater than 4 points.

If first exam notification is failed, the tests made during the year will have a 25% rate on second call (if the average mark of all test is greater than 3, otherwise the second exam notification will be like single assessment system) and problems test will have 75% rate.

- Single assessment system. Consist of a final exam that will take place at the end of the semester. This final exam will consist in performing a single test divided into two blocks. The first block with theoretic-practical activities and the second block will correspond to problems (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). The average of the qualifications of the two thematic blocks will be considered only if both blocks have been passed.

It is mandatory to pass both blocks with a mark over 5.

Students who have choose, **from the beginning of the course,** the single assessment system should inform personally to the professor in charge.

**LABORATORY EVALUATION.**

The evaluation of the laboratory will be done, as in theory problems part, by two methods continuous assessment and final exam.

- Continuous assessment system. Continuous assessment is carried out attending at all laboratory classes and the resulting note will be the average of the individual final laboratory test with continuous assessment throughout the laboratory sessions (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). It is mandatory the attendance to all laboratory classes to pass the laboratory evaluation by using the continuous assessment system. Continuous assessment during the course will take into account the average grade obtained in the resolution of the laboratory handout and the grade obtained on the test prepared by the teacher previous to the resolution of the practice (with a rate of 35% and 15% respectively) (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). This continuous assessment will be the 50% of the laboratory mark and the other 50% will be the mark obtained in the individual laboratory test scheduled in the last laboratory session (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). The mark on this exam must be over 4.
- Single assessment system: the final exam. It consists of a laboratory final exam the same day scheduled for the final exam of theory-problems (CG3, CG4, CG5, CG6, CG11, CG21 and CG22). Students who have choose,**from the beginning of the course,** the single assessment system will also have to submit all the reports asked by the professor.

To pass the laboratory evaluation using continuous assessment system, the student should obtained grades higher than five in (n-1) on the laboratory sessions and in (n-1) of the tests made by the teacher previous to each laboratory session. Being n the number of laboratory sessions.

The student who has chosen from the beginning of course continuous assessment and has not succeeded the laboratory assessment has to do the final laboratory exam. The mark obtained in this exam will be the laboratory mark.

Students who have choose **from the beginning of the course** the single assessment system should inform personally to the professor in charge.

**COURSE EVALUATION.**

The theory-problems rate is the 70% of the final mark and laboratory rate is the 30% in the final mark, being indispensable to pass both parts.

The composition of the final grade for the course for continuous assessment system and single assessment system can be seen in the next tables.

***Continuous Assessment System***

*Summary of the composition of the final grade for the Course*

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| **Activities or Concepts to evaluate** | **Assessment Method** | **Partial Assessment %** | **Final Assessment %** |
|---|---|---|---|

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First announcement

| | | | |
|---|---|---|---|
| Theory-Problems | a) Test - | 60% | 70% |
| | b) Problems | 40% | |

Second announcement

| | | | |
|---|---|---|---|
| Theory-Problems | a) Test - | 25% | 70% |
| | b) Problems | 75% | |

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|---|---|---|---|
| Laboratory sessions | 1) Previous issues | 15% | |
| | 2) Handouts | 35% | 30% |
| | 3) Individual exam | 50% | |

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|---|---|
| **Total** | **100%** |

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To average theory (multiple choice test) and problems the mark must be at least 5 in multiple choice test and 5 in problems test.

The student who has chosen from the beginning of course continuous assessment and has not succeeded the laboratory assessment, has to do the final laboratory exam. The mark obtained in this exam will be the laboratory mark.

The individual laboratory exam must be over 4 to average with the other issues.

Students who have choose **from the beginning of the course** the single assessment system should inform personally to the professor in charge.

***Single Assessment System***

*Summary of the composition of the final grade for the Course*

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| Activities or Concepts to evaluate | Assessment Method | % Final Assessment |
|---|---|---|
| Theory-Problems | 1) Final Exam: | |
| | a) Theóretic- practical activities | 45% |
| | b) Problems | 25% |
| Laboratory sessions | 1) Laboratory final exam | 20% |
| | 2) Submitted reports | 10% |
| **Total** | | **100%** |

The final exam is divided into two blocks (theoretic-practical activities and problems). The average of the qualifications of the two blocks will be considered only if both blocks have been passed

In any case, the evaluation system will be governed by that established in the Reglament de Avaluació i Qualificació de la Universitat de València per a Graus i Màsters (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639).

## REFERENCES

### Basic

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- Circuitos microelectrónicos. A.S. Sedra, K. C. Smith. McGrawHill, , 5ª Edición, ISBN 978-970-10-5472-7
- Principios de Electrónica. A. Malvino, D. J. Bates, Ed. McGraw-Hill 2007, 7ª Edición, ISBN 978-84-481-5619-0.
- Semiconductor Devices. Kanaan Kano. Ed. Prentice-Hall International, Inc. 1998, 1ª edición, ISBN 0-02-361938-4

- Electronic Devices, Discret and Integrated, S.R. Fleeman, Ed. Prentice-Hall, 1990, ISBN 0-13-336181-0.
- Circuitos electrónicos: Análisis, simulación y diseño, N.R. Malik, Ed. Prentice-Hall, 1997, ISBN 978-84-89660-03-8.

**Additional**

- Microelectrónica: Circuitos y Dispositivos. M.N. Horenstein. Prentice-Hall Hispanoamericana, S.A., 2ª Edición, ISBN 968-880-707-9.