Universidad de Alcalá

TEACHING GUIDE

Fundamentals of Electronics

Degree in
Telecommunication Technologies Engineering (GITT)
Telecommunication Systems Engineering (GIST)
Telematics Engineering (GIT)
Electronic Communications Engineering (GIEC)

Universidad de Alcalá

Academic Year 2022/2023

2nd Year - 1st Semester (GITT+GIST+GIT+GIEC)

Approved by the School Board on June 3, 2022

TEACHING GUIDE

Course Name:	**Fundamentals of Electronics**
Code:	**350011 (GITT+GIST+GIT+GIEC)**
Degree in:	**Telecommunication Technologies Engineering (GITT)** **Telecommunication Systems Engineering (GIST)** **Telematics Engineering (GIT)** **Electronic Communications Engineering (GIEC)**
Department and area:	**Electrónica** **Electronic Technology**
Type:	**Basic (GITT+GIST+GIT+GIEC)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year - 1st Semester (GITT+GIST+GIT+GIEC)**
Teachers:	Check website: http://www.depeca.uah.es
Tutoring schedule:	Check the Blackboard course
Language:	English

1. COURSE SUMMARY

The Fundamentals of Electronics module aims to introduce students to the study of the basic devices and configurations of electronic systems.

Students will learn about semiconductor devices (discrete and integrated), their characteristics and their typical applications, i.e. analog signals and commutation (switching). The module equips students with the basic concepts and techniques which are necessary for successfully studying electronic circuits in subsequent modules.

In order to be able to benefit from this module students must have studied Circuit Theory and Circuit Analysis in the first year of their degree. It is also recommended that students have studied Digital Electronics and Fundamentals of Physics II.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/352/2009:

en_TR2 - Knowledge of basic subjects and technologies that enables to learn new methods and technologies, as well as to provide versatility that allows adaptation to new situations.

en_TR8 - Capacity of working in a multidisciplinary and multilingual team and of communicating, both in spoken and written language, knowledge, procedures, results and ideas related to telecommunications and electronics.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/352/2009:

en_CB4 - Understanding of: the basic concepts about linear systems and their associated functions and transform domains, theory of electrical circuits, electronic circuits, semiconductor physical principles, electronic and photonic devices, materials technology and its applications to solve engineering problems.

Learning Outcomes

Students should be able to do the following upon completion of this course:

RA1. To describe and to apply the operation principle and uses of analog electronics devices such as the operational amplifier, the pn-junction diode and the transistor.

RA2. To determine and to inspect analog circuits for basic applications in amplification and switching.

RA3. To use laboratory test equipment useful in an analog electronics laboratory, also using computer software tools for simulating electronics circuits.

RA4. To work effectively in a group for evaluating experimental results and writing technical lab reports from these results.

3. CONTENTS

Module Contents (The topics may be further clarified if necessary)	Total number of hours
Introduction. Core concepts of amplification and modeling. Fundamentals properties of amplifiers	4 hours
Operational amplifiers. Basic amplifier configurations. Linear applications (voltage follower, inverting amplifier, I-V and V-I converters, differential amplifier, instrumentation amplifier, differentiator, integrator) The real operational amplifier.	12 hours
Diodes. Operation principle. Characteristics curves. DC model. Diode types: zener, photodiodes and LEDs.	5 hours
Bipolar transistors. Operation principle. Models for DC operation I-V characteristics. Second order effects. Biasing.	5 hours
Field effect transistors. Operation principle. Models for DC operation I-V characteristics. Second order effects. Biasing.	3 hours
Transistor biasing. Safe operation region (SOR). Bias point stability. Sensitivity.	2 hours
Linear models of transistors and diodes for small signal operation. Linear equivalent circuits, parameters and amplifier circuits.	5 hours
Non-linear models of transistors, diodes and operational amplifiers. Switching models of diodes. Switching models of transistors. Logic families. Non-linear applications of operational amplifiers, comparators	6 hours
Laboratory practicals: Simulation tools. Operational amplifiers, diodes and transistors.	12 hours

TEACHING SCHEDULE

The teaching schedules for this module will coincide with the official academic calendar. They will be published at the beginning of the module.

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

The learning and teaching activities for this module are as follows:

- Theory-based classes
- Practical classes: problem solving.
- Practical classes: laboratory
- Tutorials: individual or in groups.

The following additional resources may also be used:

- Individual and group work: This will involve both the work itself as well as the presentation of this work in class in order to encourage class discussion.
- Conferences, meetings and scientific discussions related to the module material.

Throughout the module, students must participate in various theoretical and practical activities. The practical work will be synchronized with the teaching of theoretical concepts so that students can consolidate and carry out experiments related to the concepts learned, both individually and in groups.

In order to carry out these practicals students will work in a laboratory with basic equipment (oscilloscope, power supply, signal generator) and computers with software for designing and simulating electronic circuits. Students are advised to carry out these practicals in groups of two.

Throughout the learning process for the module students must make use of various bibliographic materials and electronic resources in order to familiarize themselves with the resources that they will need to use later in a professional environment.

The teaching faculty will provide students with the relevant learning resources for the module (theoretical foundations, exercises and problems, practical manuals, audiovisual references, etc. These materials will allow students to meet the objectives of the module and develop the skills outlined in Section 2.

Throughout the module, students will be able to participate in scheduled tutorials. These may be individual or in groups, depending on the needs of the student in question. In either case these tutorials will allow students to resolve problems and consolidate learning. The tutorials will also enable instructors to monitor students' progress and evaluate the effectiveness of the teaching-learning methodology.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Regulations for the Regulation of Teaching Learning Processes, NRPEA, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Regulations for the Evaluation of Apprenticeships (approved by the Governing Council on March 24, 2011 and modified in the Board of Directors). Government of May 5, 2016) as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

According to current regulations and considered the essential experimental laboratory for the acquisition

of target skills of the subject Fundamentals of Electronics, attendance at all lab sessions and overcoming the compulsory attendance will be considered an essential element of the evaluation, both in the ordinary and the extraordinary calls (regulations of the processes of learning assessment approved by the Governing Council of 24 March 2011 and modified on 5th May 2016, Article 6, paragraph 4). For this reason, the labs are common and essential in the two types of assessment: continuous and not continuous.

The assessment procedures, for both the ordinary and extraordinary calls are outlined below:

Ordinary evaluation:

Continuous assessment

a. Take the continuous assessment exercises and test proposed during the course.
b. Laboratory practicals. They are compulsory, being related to material learned in the module's theoretical component.

Not Continuous assessment

Students who opt for the final assessment process must pass a final exam which consists of the following:

a. A theoretical and practical exam which covers all topics studied in theory-based classes and in exercises.
b. A practical laboratory exam which focuses on the objectives specified for the practical component of the module.

Extraordinary evaluation

Continuous assessment:

For students who fail to achieve a mark of at least 5 out of 10 in the continuous assessment for the ordinary evaluation, the extraordinary evaluation will consist of the following:

a. A theoretical and practical exam which covers all topics studied in theory-based classes and in exercises.
b. A theorical-practical laboratory test that will cover the intended targets in the corresponding part of the course for those students who did not pass the laboratory practices. The practice note from the ordinary call may be kept for the special call if a student had done the labs and successfully completed the evaluation of competencies related to the same

Non continuous assessment:

The procedure and assessment criteria for this type of assessment are the same for both assessment sessions.

5.2. EVALUATION

EVALUATION CRITERIA

The assessment process is designed to evaluate the extent to which students have acquired the skills outlined in Section 2. Consequently, the assessment criteria which are applied in the different components of the assessment process ensure that students have reached a sufficient level of proficiency in the following areas of knowledge and skills:

CE1. Knowledge of the fundamental properties of electronic devices, applicable models and their scope of operation.

CE2. Ability to apply basic theoretical knowledge and corresponding problem-solving strategies in

the analysis of basic electronic circuits.

CE3. Ability to successfully complete simple exercises related to the synthesis of electronic circuits according to a set of specifications.

CE4. Ability to rationally justify the steps taken to solve problems related to the analysis and synthesis of electronic circuits.

CE5. Ability to set up basic electronic circuits without any errors and measure their characteristics and fundamental parameters.

CE6. Ability to effectively document theoretical and practical work completed by applying a rational approach.

GRADING TOOLS

The following assessment tools will be used:

a. Classroom theoretical and practical exercises proposed during the course (En)
b. Continuous assessment tests (PEI). which contain a number of questions (analysis and/or synthesis) based on specific aspects of one or more topics in the syllabus.
c. Laboratory practicals (PL)
d. Supplementary exam (PC) which contains questions (analysis and/or synthesis) based on specific aspects of the syllabus covered in theory-based classes, exercises and laboratory practicals.
e. Final exam (PEF) which contains questions (analysis and/or synthesis) based on specific aspects of the syllabus covered in theory-based classes, exercises and laboratory practicals

GRADING CRITERIA

Ordinary evaluation:

Continuous assessment

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR8	RA3, RA4	CE5, CE6	PL	20%
CB4	RA1, RA2	CE1, CE2, CE3, CE4	En	15%
CB4	RA1, RA2	CE1, CE2, CE3, CE4	PEI	25%
TR2, CB4	RA1, RA2	CE1, CE2, CE3, CE4	PC	40%

In order to pass the continuous assessment process, students must meet the following conditions:

- Take the PEI assessment.
- To overcome successfully the evaluation of competencies related to the labs. A student successfully acquires these skills if he/she attends to the lab sessions and the ranking in all the tests related is more than 45% of the maximum possible score.
- To overcome successfully the evaluation of competencies related to the theoretical evidence of the subject. A student successfully acquires these skills if the score on the tests related is more than 45% of the maximum possible score. The aim of this exam is to evaluate the skills acquired by the student during this course even if they were previously evaluated through the continuous assessment process. Therefore, the supplementary exam allows the improvement of the final mark of the student when the mark of this supplementary exam is higher than the obtained one considering the whole continuous evaluation procedure.
- For students who overcome successfully the evaluation of competencies related to laboratory and theory of the subject, to achieve an overall weighted mark of at least 5 out of 10.
- For students who do not overcome successfully both subject parts, theory and laboratory, the final mark will be the lowest one among the following:

- The overall weighted mark.
- 4.5 out of 10, for overall weighted mark higher than 4.5 out of 10.

Students who do not apply for the supplementary exam will be marked as “absent” for the ordinary evaluation. If the student had attended to the labs and successfully completed the evaluation of competencies related to them, may maintain its practice mark for the extraordinary call.

Not Continuous assessment

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2, CB4	RA1, RA2	CE1, CE2, CE3,- CE4	PEF	80%
TR8	RA3, RA4	CE5, CE6	PL	20%

Extraordinary evaluation:

The criteria to pass the course in the extraordinary evaluation will be the same as in the ordinary evaluation.

Continuous assessment.

For students who fail to achieve a mark of at least 5 out of 10 in the continuous assessment for the ordinary evaluation, the extraordinary evaluation will consist of the following:

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2, CB4	RA1, RA2	CE1, CE2, CE3,- CE4	PEF	80%
TR8	RA3, RA4	CE5, CE6	PL	20%

Not continuous assessment:

The procedure and assessment criteria for this type of assessment are the same for both assessment sessions

CHARACTERISTICS OF THE CONTINUOUS ASSESMENT PROCEDURE

The characteristics of the continuous assessment procedure are as follows:

- It enables students to become familiar with the assessment criteria and grading system for the module from the very beginning, through real, objective tests.
- It provides students with feedback on their progress (i.e. knowledge and skills acquired) at regular intervals.
- It provides the teaching faculty with a means of evaluating the quality of the teaching-learning process from the very beginning of the module.
- The instructors may decide not to exclude material already passed in the continuous assessment procedure from the final exam, since the objective of this final exam is to evaluate the overall acquisition of the skills outlined in Section 2.
- The continuous assessment tests may be viewed as tools which enable students to engage in self-assessment and to improve their own learning process, while not being penalized for failure in these tests.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

The instructor will provide the necessary documentation by posting it on the Web of the subject or it will be directly submitted to the students.

- Electronic Circuits: Analysis, Simulation, and Design. Norbert R. Malik, Ed. Prentice Hall, Madrid 1996. ISBN: 84-89660-03-4.
- Microelectronics Circuits. Sedra / Smith. Ed. Oxford. ISBN: 970-613-379-8.
- Electrónica. Allan R. Hambley. Ed. Pearson Education, Madrid 2001. ISBN: 84-205-2999-0

6.2. Additional Bibliography

• F. Espinosa, R. García, J.L. Lázaro, J. Ureña, “Componentes Electrónicos”. Servicio de publicaciones de la Universidad de Alcalá. ISBN: 84-8138-995-1.
• M. Mazo, J.J. García, S.E. Palazuelos, “Dispositivos Electrónicos II”, Servicio de publicaciones de la Universidad de Alcalá. ISBN: 84-8138-630-8.
• R. Barea, M. Domínguez, M.S. Escudero, R. García, A. Gardel, M. Guerra, E. López, “Problemas de componentes electrónicos”. Servicio de publicaciones de la Universidad de Alcalá. ISBN: 84-8138-408-9.
• R.L Boylestad, L. Nashelsky, “Electrónica: teoría de circuitos y dispositivos electrónicos”. Pearson Prentice Hall, 2003 (8ª ed.). ISBN:970-2-0436-2.
• J. Millman, A. Gravel, “Microelectrónica“, Editorial Hispano Europea S. A., 1991. ISBN: 84-255-0885-1.

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.