



Universitat de Lleida

DEGREE CURRICULUM
ANALOGUE ELECTRONICS

Coordination: GARRIGA CASTILLO, JUAN ANTONIO

Academic year 2023-24

Subject's general information

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|---|---|---------------|------------------|------------------|
| Subject name | ANALOGUE ELECTRONICS | | | |
| Code | 102123 | | | |
| Semester | 1st Q(SEMESTER) CONTINUED EVALUATION | | | |
| Typology | Degree | Course | Character | Modality |
| | Bachelor's Degree in Automation and Industrial Electronic Engineering | 3 | COMPULSORY | Attendance-based |
| Course number of credits (ECTS) | 6 | | | |
| Type of activity, credits, and groups | Activity type | PRALAB | PRAULA | TEORIA |
| | Number of credits | 0.4 | 2.6 | 3 |
| | Number of groups | 2 | 2 | 1 |
| Coordination | GARRIGA CASTILLO, JUAN ANTONIO | | | |
| Department | INDUSTRIAL AND BUILDING ENGINEERING | | | |
| Teaching load distribution between lectures and independent student work | 60h of class 90h of autonomous work 1 ECTS = 10h of class + 15 h of autonomous work | | | |
| Important information on data processing | Consult this link for more information. | | | |
| Language | Català 20.0 Castellà 80.0 | | | |

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|--------------------------------|-----------------------------|---------------------------|---|
| GARRIGA CASTILLO, JUAN ANTONIO | juanantonio.garriga@udl.cat | 9 | Monday from 7:00 p.m. at 9:00 pm. / office 2.18 entry by 2.19. Tuesday from 5:00 p.m. until 7:00 p.m. / Office 2.18 entry by 2.19. |

Subject's extra information

As previously described analogue electronics relies heavily on the knowledge and skills acquired in the subjects of Circuit Theory and Electronic Engineering Fundamentals making it very important that the students have taken the courses and studied the subjecta earlier. Without this knowledge base the course will provide a high level of difficulty to the student that takes it for the first time. It is also considered very convenient to have computer skills to manage electronic simulation programs around a personal computer.

Analogue Electronics is a 6-credit course, mandatory, which is taught in the first semester of the third year of the Degree in Electronic Industrial Engineering and Automation. This course complements the subject of Fundamentals of Electronic Engineering, we study the electronics part which is associated to the analog signal processing and therefore most of the circuits built around the operational amplifier and other integrated circuits.

Thus requires knowledge and skills acquired in the course Fundamentals of Electronic Engineering and other acquired skills, specifically in the subject Circuit Theory.

Learning objectives

- Provide students with the necessary knowledge to develop operating analog electronic systems.
- To study the main functional elements of analog electronics.
- Apply techniques that allow the use of reliable and economical.
- Establish the knowledge of discrete electronic devices, and their use in circuit design.
- Designing electronic circuits that meet certain specifications.
- Compare the knowledge acquired in theory with the results obtained in the laboratory.

Competences

Cross - disciplinary competences

- **EPS1.** Capacity to solve problems and prepare and defence arguments inside the area of studies.
- **EPS6.** Capacity of analysis and synthesis

Specific competences

- **GEEIA20.** Knowledge of the basics and applications of the analogue electronics.
- **GEEIA21.** Knowledge of the basics and applications of the digital electronics and microprocessors.
- **GEEIA22.** Applied knowledge of power electronics.
- **GEEIA23.** Applied knowledge of electronic instrumentation
- **GEEIA24.** Capacity to design analogue, digital and power electronic systems.

Subject contents

1. Differential and multistage integrated amplifiers.
 - 1.1. Polarization of integrated circuits with bipolar transistors
 - 1.2. Polarization integrated circuits FET
 - 1.3. differential amplifier

2. Operational Amplifiers.
 - 2.1. The ideal operational amplifier
 - 2.2. Linear circuits with operational amplifier.
 - 2.3. nonlinear circuits with Operational Amplifier.
 - 2.4. Non-ideal properties of operational amplifiers.

 - 2.5. Converters A/D and D/A
3. Feedback and oscillators.
 - 3.1. Feedback effects on profit
 - 3.2. practical feedback networks
 - 3.3. Design of amplifiers with feedback
 - 3.4. Frequency response.
 - 3.5. Principles oscillator
4. Formers wave circuits and data converters.
 - 4.1. comparators and Schmitt trigger circuit
 - 4.2. astable multivibrators
 - 4.3. The timer 555
 - 4.4. Converters A/D and D/A
5. Active filters and tuned circuits.
 - 5.1. Types of active filters
 - 5.2. Series and parallel resonant circuits
 - 5.3. Impedance matching networks.
 - 5.4. tuned amplifiers

Methodology

Classroom activities are divided into three parts: lectures, problem solving and practices.

- **Lectures:** In the lectures the contents of the subject are presented orally by a lecturer without the active participation of students.
- **Troubleshooting:** In the problem-solving activity, the teacher presents a complex issue that students must solve, either working individually or in teams.
- **Practices:** Let you apply and configure a practical level, the theory of a field of knowledge in a particular context. Before entering the lab, the student must have previously analyzed and simulated circuit to ride and show a pre-report.

The kinds of problems and practices will be taught in small groups of students. Having smaller groups of students, promotes dialogue and participation thereof.

The non-contact activities are divided into two parts: strengthen their knowledge autonomously based on the teaching material provided or recommended by the teacher, and reporting on the development of practices.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

<http://www.publicacions.udl.cat/>

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: <http://www.sprl.udl.cat/alumnes/index.html>

Development plan

| Week | Methodology | Temary | Contact hours | Independent work hours |
|------|------------------------------------|------------------------------|---------------|------------------------|
| 1-2 | Master class problems | Tema1 | 8 h | 12 h |
| 3 | Master class Simulation | Tema 1 | 4 h | 6 h |
| 4-5 | Master class Practices | Tema 2 | 8 h | 12 h |
| 6-7 | Master class problems | Tema 2 | 8 h | 12 h |
| 8 | Master class Simulation | Tema 2 | 4 h | 6 h |
| 9 | Written test Delivery practices | Tema 1 a Tema 2 Practices | 2 h | |

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|-------|------------------------------------|------------------------------|-----|------|
| 10-11 | Master class Practices | Tema 3 | 8 h | 12 h |
| 12 | Master class problems | Tema 4 | 4 h | 6 h |
| 13 | Master class Simulation | Tema 5 | 4 h | 6 h |
| 14-15 | Master class Practices | Tema 6 | 8 h | 12 h |
| 16 | Written test Delivery practices | Tema 3 a Tema 6 Practices | 2 h | |

During the first weeks of the course theory classes and problems develop first topic, and then (about the 3rd week) practice sessions were initiated in the laboratory for the issue developed.

This development plan will be conducted throughout the course, so, in the laboratory practices will be performed once acquired knowledge to carry them out.

The corresponding practical reports will be delivered as the same day deadline set for the completion of the partial examination, must contain the theoretical results, simulated and those obtained in the laboratory, practices made to date.

Evaluation

To pass the subject it is necessary to pass each of the two evaluation blocks: theory and practicals.

The maximum qualification of the evaluation blocks will only be obtained when the activities of each block are delivered within the established deadlines and days.

Attendance at laboratory practices is compulsory.

Theory (Exams) 70%, first partial 35%, second partial 35%. The minimum mark in each partial exam to be able to average with the other, will be 4 out of 10. Minimum theory mark to pass the subject 5.

Practices 30% (Problems-Non-contact work and Laboratory):

Laboratory Practices (Assistance + Reports) 20%, the reports must contain the corresponding analysis of the practice, the simulation and the empirical data obtained. Practices from previous years will not be validated.

Problems-Non-classroom work (Collection of solved problems, at least the correct resolution of the exams within the maximum agreed period) 10%

The recovery exams will only be used to pass students who did not present or failed in the partial exams (maximum mark to be reached in the recovery 6 points) and for those who, having passed the partial exams, want to raise their grade (previous request is necessary).

In the case of substituting exam questions on a certain topic for papers, the minimum grade to be obtained from the exam for the papers to be counted will be 50% of the rest of the exam questions.

The maximum qualification in the recovery of the Laboratory practices will be approved (1 point out of 2).

This evaluation will also apply to students who, after requesting the alternative evaluation system, have been granted it, so they must attend the laboratory to do the practicals, being exempt from attending problem and theory classes.

INSTRUCTIONS FOR THE CORRECT DEVELOPMENT REVIEW

Present the DNI / Passport in the test.

Always follow the instructions of the teacher in the allocation of seats to fill.

Leave necessarily always visible on the table ID / Passport, writing utensils and possible materials authorized for testing.

Leave folders, bags and / or backpacks where the professor noted.

Mobile phones or any telecommunications device must be disconnected and stored in bags or backpacks. The use of these devices and some other unauthorized material is strictly forbidden. If it detects that a student has activated, it will be expelled from the examination with the consequences arising.

You can not answer pencil, nor red or green ink.

While performing tests all students must have the pinna (ear) discovered for verification that they are not using hearing aids not allowed. During the exam students must always have both hands visible.

Correction and absolute silence during the examination.

The teacher may expel any student test violates these standards, with the consequences arising.

GENERAL CRITERIA FOR THE CORRECTION OF TESTS

If you consider a section divided in approach ("We ..." "You ask ..."), development ("The application of Theorem with this hypothesis allows ...") and resolution ("In the expression of the theorem is replaced ... and simplifying get ... ") until the result, to gain score paragraph must be presented in an orderly and intelligible development.

One result is rejected if the source, that is to present a coherent development with the statement (no need to make an explicit approach, or copy or recreate the statement) is not indicated.

For maximum score is required, where applicable:

- Getting the correct numerical result with SI units (International System).
- Presenting graphic indicating the scales with correct units.
- Present schemes, block diagrams, etc. unambiguously.
- Pulchritude, conciseness, accuracy and clarity of presentation will be highly valued.

It is heavily penalized so could nullify the score in a section:

- The dimensional and conceptual errors in reasoning.
- The results without units or SI units are not.
- The numerical errors that lead to reasonable results only slightly penalized.
- Other numerical errors can become considered misconceptions.
- In chained questions are not heavily penalized errors arising from the above results, provided that taking

these as data does not represent a conceptual error and the results derived are reasonable.

Bibliography

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Autor/es: Hambley, Allan ;

Editorial: PRENTICE-HALL

Título: ANALISIS DE CIRCUITOS EN INGENIERIA.

Autor/es: William H. Hayt, Jack E. Kemmerly, Jamie D. Phillips, Steven M. Durbin

Editorial: McGrawHill

Título: CIRCUITOS MICROELECTRONICOS. Análisis y diseño

Autor/es: Muhammad H. Rashid

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Título: AMPLIFICADORES OPERACIONALES Y CIRCUITOS INTEGRADOS LINEALES

Autor/es: Coughlin, Robert F. ; Driscoll, Frederick F.

Editorial: PRENTICE-HALL.

Título: FUNDAMENTOS FISICOS DE LA INGENIERIA. ELECTRICIDAD Y ELECTRONICA.

Autor/es: Juan Vicente Miguez, Francisco Mur, Manuel Alonso Castro, Jose Carpio

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Título: FUNDAMENTOS FISICOS DE LA INGENIERIA. 450 problemas resueltos de Electromagnetismo, electricidad y electrónica.

Autor/es: Juan Vicente Miguez, Nuria Oliva, Elio San Cristobal, Jose Carpio

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Título: CIRCUITOS ELECTRONICOS: DISCRETOS E INTEGRADOS

Autor/es: Donald L. Schilling - Charles Belove

Editorial: Mc Graw Hill

Título: ELECTRONICA: Teoria de Circuitos

Autor/es: Robert L. Boylestad - Louis Nashelsky

Editorial: Prentice Hall

Título: CIRCUITOS ELECTRONICOS: Análisis, Simulación y Diseño

Autor/es: Norbert R. Malik

Editorial: Prentice Hall

Título: MICROELECTRONICA: CIRCUITOS Y DISPOSITIVOS

Autor/es: Mark N. Horenstein

Editorial: Prentice Hall