COURSE DATA

Data Subject	
Code	34810
Name	Instrumentation and Electronic Equipment
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1402 - Degree in Telecommunications Electronic Engineering	School of Engineering	3	Second term

Subject-matter

Degree	Subject-matter	Character
1402 - Degree in Telecommunications Electronic Engineering	15 - Electronic instrumentation, equipment and products	Obligatory

Coordination

Name	Department
PEREZ SOLER, JOAQUIN	242 - Electronic Engineering
RAMIREZ MUÑOZ, DIEGO	242 - Electronic Engineering

SUMMARY

The subject Instrumentation and Electronic Equipment is intended for students interested to know the real possibilities of basic electronic equipment that can be found in a lab and to learn to make correct measurements of variables of electrical and nonelectrical nature. Special emphasis is placed on the limitations of electronic equipment and its influence on the accuracy of the measurements made with them.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Competences in calculus and mathematical analysis, circuit and linear systems analysis, especially: Kyrchhoff current law, superposition and Thévenin theorems, input impedances calculus, development of periodic functions in Fourier series and fundamental concepts of network functions.

OUTCOMES

1402 - Degree in Telecommunications Electronic Engineering

- G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making and creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of a telecommunications technical engineer.
- G5 - Knowledge to carry out measurements, calculations, assessments, evaluations, loss adjustments, studies, reports, task planning, and other analogous work in the specific field of telecommunications.
- G9 - Ability to work in a multidisciplinary environment and in a multilingual group and to communicate, in writing and orally, knowledge, procedures, results and ideas related to telecommunications and electronics.
- G6 - Ability in the handling of specifications, regulations and norms of compulsory compliance.
- TE3 - Ability to specify, implement, document and set-up electronics, instrumentation and control equipment and systems, considering both technical aspects and the relevant regulatory requirements.
- TE8 - Ability to specify and use electronic instrumentation and measurement systems.
- TE9 - Ability to analyze and solve the problems of interference and electromagnetic compatibility.

LEARNING OUTCOMES

• RA-1. Be able to perform basic electronic equipment measurements relating to the accuracy limitations of the measuring system. Contributes to acquire the outcomes: G3, G5, G6, G9, TE3, TE8.

• RA-2. Determine which is the contribution to the accuracy of the measuring system of the various stages that constitute the basis of their actual behavior. Contributes to acquire the outcomes: G3, G5, TE3, TE8.

• RA-3. Ability to apply the appropriate electronic conditioning for measuring certain variable by using a specific sensor. Contributes to acquire the outcomes: G3, G4, G5, G6, G9, TE3, TE8.

• RA-4. Being able to propose valid solutions to new problems of sensing and signal conditioning.
Contributes to acquire the outcomes: G3, G4, G5, G6, G9.

DESCRIPTION OF CONTENTS

1. General principles of measurement systems.

General concepts and terminology. Characteristics of the measurement systems. Measurement errors. Types of errors: random and systematic. Uncertainty and laws of propagation. Least-squares fit.Deshacer cambios

2. The digital multimeter.

Overview of a digital multimeter. Main stages. Interpretation of specifications: accuracy.

3. Signal sources.

Introduction. Interpretation of the manufacturer's specifications. Basic signal generation. Arbitrary signal generation. Generation of arbitrary waveforms.

4. The oscilloscope.

Introduction. The vertical system. The horizontal system. The trigger system. Sampling modes of digital oscilloscopes. Oscilloscope probes.

5. RLC impedances meaurements circuits.

6. Sensors.

Classification of sensors. Resistive sensors: RTD, thermistors and strain gauges. Capacitive sensors. Photodiodes.

7. Conditioning circuits.

Conditioning circuits for resistive sensors: Wheatstone bridge, difference amplifier and instrumentation amplifier. Pseudobridges. Current-to-voltage converters. Influence of the imbalances of the operational amplifiers in measurements.

8. Laboratory.

1 Measurements with the digital multimeter.
2 The function generator.
3 Design and verification of signal generating circuits.
4 Measurements with the oscilloscope and passive probes
5 Temperature sensing and conditioning for nursery care.
6 Design of a drive with a linearized thermistor for safe environments in dependent care.
7 Pressure measurement with piezoresistive sensor and instrument amplifier and its application in e-health.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	20,00	100
Theory classes	20,00	100
Classroom practices	20,00	100
Development of group work	24,00	0
Study and independent work	30,00	0
Preparation of evaluation activities	11,00	0
Preparing lectures	8,00	0
Preparation of practical classes and problem	17,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the course is structured around four themes: the theory sessions, problems, tutorials, continuous evaluation tests, and presentation of technical documentation practices. Group learning with the teacher

Group learning with the teacher (G3, G4, G5, G6, G9, TE3, TE8)

In that case (sessions of theory and problems), the lecture model will be used. At the excercise class, the teacher will explain a number of problems by which the student will learn to identify the essential elements to solve them. These sessions will also use the participatory approach in order to facilitate communication between students and student / teacher.

Tutorial time (G3, G4, G5)

The students have a schedule of tutorial time aimed to solving the problems, doubts, work orientation, etc.. The schedule of these tutorials will be indicated at the beginning of the academic year.

Individual Study

The student may submit the resolution of a series of proposed tests. These must be resolved exclusively by the students without any help from the teacher.

Laboratory sessions (G5, G6, G9)

They will be organized around groups preferably formed by two people who should be planned for the design, assembly and different experimental works. At any time, if the teacher sees fit, the working group may be separated so that each member worked individually. Each practice combines experimental and theoretical activities, the estimated time for resolution is 3 hours.

Teaching materials

The student will have in the virtual classroom over the academic year, the following documents:

Teaching Guide: provides sufficient data elements to determine what it is intended that the student learns, how it will do, under what conditions and how it will be evaluated.

Presentations from each of the course topics.

Practical exercices of each lesson.

Continuous Tests (PECs) of each of the lessons.

The script of laboratory practices.

EVALUATION

In the first and second evaluation calls the theory and laboratory work will be examined with a weight on the final grade of 60% and 40% respectively. For averaging the ratings of theory and laboratory the students must obtain marks equal or greater than 4 on each one.

Getting the theory marks (G3, G4, G5, G6, G9, TE3, TE8)

At the **first evaluation call**, the theory marks will be calculated as a result of:

1. A written exam consisting of practical issues related to the course contents. The value will be 30% of the final subject mark.

2. As a formative assessment, the student will deliver on the date specified by the professors continuous tests (CT), reports on activities and others. Whatever CT not delivered will be computed as zero at the time to compute the average marks of this item. The value will be 30% of the final subject mark.

In that way, the theory marks will be obtained according to the following expression:

MarkTheory=0,8 x MarkWritten exam + 0,2 x CTsAverage

At the **second evaluation call**, the theory marks will emerge as a result of:

1. A written exam consisting of practical issues related to the course contents. The value will be 60% of the final subject mark.

Getting the laboratory marks (G3, G4, G5, G6, G9, TE3, TE8)

Note: Attendance to laboratory classes is compulsory and in any case it must be satisfied that explained in the point 9, art. 6 of the Reglament d'avaluació i qualificació de la Universitat de València per a títols de Grau i Màster.

Depending on the characteristics of the practice it will be shown, prior to entry in the laboratory certain calculations and designs necessary for the realization of the experience. The lab session will not be countable if they have not been made previously the proposed activities.

At the **first evaluation call** the laboratory marks will be the result of the three following assessments:

1. Laboratory Session (SL). It will assess the skill demonstrated, the interest in the assembly, the mastery in the use of laboratory equipment and the execution of the practice throughout the session. All this will score 40% of the laboratory marks.

2. Delivery of activities, questions and laboratory manuals verification (CU). The professors will inform about the specific experimental activities the laboratory group must deliver within the specified period of time. Concerning to the laboratory manual, this can be requested at any time throughout the academic course since students must deliver it in the same session as the teacher requires it. The organization and capacity of the laboratory group and the clarity in the presentation and the designs will be valued. This part will score 40% of the lab marks.

3. Implementation of a practical assembly (MP). It will be carried out by the group at the last lab session. It must be analyzed and previously designed before the laboratory session as individual work. This part will score 20% of the lab marks.

In the **second evaluation call** the students must:

1. Delivery of completed non-presential practice scripts (GP). These will score 40% of the laboratory mark.

2. On the official date of the exam, students will have 3 hours to take a theoretical/practical exam that will include laboratory questions and/or the experimental set-up and adjustment of a proposed circuit (ME). This part will account for 60% of the laboratory mark.

If any of the parts (Theory or Laboratory) has a grade mark lower than 4 it will not give rise to averaging and it will have to be recovered in a later evaluation call. The final mark of the subject, provided the theory and lab marks are equal or greater than 4, will be obtained according to the following expression:

MarkSubject=0,6 x MarkTheory+ 0,4 x MarkLab

	Theory marks (60%)	Laboratory marks (40%)
First evaluation call	Examination (50%) + CT (50%) Minimum score of 4 out of 10 on the test for averaging	SL (40%) + CU (40%) +Practical final assembly (20%) Minimum score of 4 out of 10 for averaging.
Second evaluation call	Examination (100%) Minimum score of 4 out of 10 on the test for averaging	Lab scripts MP (40%) + Practical Exam (60%) Minimum score of 4 out of 10 for averaging

In the event of a closure of the facilities due to the health situation that affects all or part of the classes of the subject, these will be replaced by non-presential sessions following the established schedules. If the closure affects a course evaluation test, it will be replaced by a test of a similar nature that will be carried out in virtual mode through the University of Valencia's institutional support tools. The percentages of each assessment test will remain unchanged, as established by this guide.

According to the Universitat de València's regulation, copying or performing any fraudulent action during the exams will turn out in a zero qualification and the beginning of the process according to the University regulation.

In any case, the system of evaluation will be ruled by the established in the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters. (http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf).

REFERENCES

Basic

- Mercedes Granda Miguel, Elena Mediavilla Bolado , Instrumentación electrónica : transductores y acondicionadores de señal, PUbliCan, Ediciones de la Universidad de Cantabria, [2010] ISBN: 978-84-8102-747-1
- Pallàs Areny, R.: Instrumentos electrónicos básicos. Ed. Marcombo, Barcelona, 2006.
- Franco, S.: Diseño con amplificadores operacionales y circuitos integrados analógicos. McGraw-Hill, NY, 2005.
- Pallàs Areny, R.: Sensores y acondicionadores de señal. Ed. Marcombo, Barcelona, 2001.

Additional

- Salicone, Simona, Measuring Uncertainty within the Theory of Evidence, : Springer International Publishing, 2018. ISBN 978-3-319-74139-0
- Wolf, S., Smith, R. F.: Student Reference Manual for Electronic Instrumentation Laboratories +Labview Student Package, 2/E, Prentice Hall, Pomona 2004.
- Witte, R. A.: Electronic Test Instruments: Theory and Application, Prentice Hall, NJ 1993.
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- Pallás Areny, R., Webster, J. G.: Sensors and signal conditioning, New York : J. Wiley and Sons, c2001, web isbn: 0-471332-32-1.
- Fraile Mora, J. , Instrumentación aplicada a la ingeniería, Ed. Garceta, 2013

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

The contents initially included in the teaching guide are maintained.

Workload and temporary teaching planning

The different activities described in the teaching guide are maintained with the planned dedication.

The material for the follow-up of the classes of theory/practices allows to continue with the professor of temporary planning so much in days as in schedule, so much if the teaching is face-to-face in the classroom or if it is not.

Teaching methodology

In classroom theory and practices, students will tend to have the maximum physical attendance possible, always respecting the sanitary restrictions that limit the capacity of the classrooms as indicated by the competent public health authorities to the estimated percentage of their usual occupation.

Depending on the capacity of the classroom and the number of students enrolled, it may be necessary to distribute the students into two groups. If this situation arises, each group will attend classroom theory and practical sessions with physical presence in the classroom by rotating shifts, thus ensuring compliance with the criteria for occupying spaces.

The rotation system will be established once the actual enrollment data is known, guaranteeing, in any case, that the attendance percentage of all the students enrolled in the subject is the same.

With respect to laboratory practices, attendance at sessions scheduled in the schedule will be totally face-to-face.

Once the actual enrollment data is available and the availability of spaces is known, the Academic Committee of the Degree will approve the Teaching Model of the Degree and its adaptation to each subject, establishing in said model the specific conditions in which it will be developed teaching the subject.

If there is a closure of the facilities for sanitary reasons that totally or partially affects the classes of the subject, these will be replaced by non-contact sessions following the established schedules.

Evaluation

The evaluation system described in the teaching guide of the subject in which the different evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.

If there is a closure of the facilities for health reasons that affect the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the Universitat de València.

The contribution of each evaluable activity to the final grade for the course will remain unchanged, as established in this guide.

Bibliography

The bibliography recommended in the teaching guide.