COURSE DATA

Data Subject	
Code	34938
Name	Instrumentation and electronic equipment
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	3	First term

Subject-matter

Degree	Subject-matter	Character
1404 - Degree in Industrial Electronic Engineering	16 - Electronic systems	Obligatory

Coordination

Name	Department
RAMIREZ MUÑOZ, DIEGO	242 - Electronic Engineering

SUMMARY

This is a subject that is taught quarterly in the third year of the Degree of Industrial Electronics Engineering with a total of 6 ECTS credits. This course is intended for students interested to know the real possibilities of the basic electronic equipment that can be found in a lab and learn to make correct measurements of variables of electrical and nonelectrical nature. Also, describes the data acquisition and distribution systems, the hardware and software that configures a virtual instrumentation system and some specific electronic equipment such as spectrum analyzer and equipment to measure low level signals.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

It is highly desirable that students have knowledge of analysis and mathematical calculus, electrical network theory and analogue and digital components.

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).
- CG6 - Ability to deal with specifications, regulations and mandatory standards.
- CE2 - Knowledge of the basics and applications of analogue electronics.
- CE5 - Applied knowledge of electronic instrumentation.
- CE6 - Ability to design analogue, digital and power electronic systems.

LEARNING OUTCOMES

• Be able to perform basic electronic equipment measurements relating to the accuracy limitations of the measuring system. Contributes to acquire the outcomes: CG3, CG4, CG6, CE5.

• Ability to apply the appropriate electronic conditioning for measuring certain variable by using a specific sensor. Contributes to acquire the outcomes: CG3, CG4, CG6, CE2, CE6.

• Being able to propose valid solutions to new problems of sensing and signal conditioning. Contributes to acquire the outcomes: CG3, CG4, CG6, CE2, CE6.

• Ability to develop and control electronic engineering systems oriented to test and measurement. Contributes to acquire the outcomes: CG3, CG4, CG6, CE5.

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. Most relevant technical specifications.

3. Signal generators.

Introduction. Most relevant technical specifications. Basic signal generation. Arbitrary signal generation. Generation of arbitrary waveforms.

4. The oscilloscope.

Introduction. The vertical system. The horizontal system. The trigger system. Analog and digital oscilloscopes. Oscilloscope probes.

5. RLC impedances meaurements circuits.

Introduction. Resistance measurements: DC bridges (Wheatstone and Kelvin). Capacitance and inductance measurements.

6. Sensors and signal conditioning circuits.

Resistive sensors (RTD, termistors and strain gauges), differential and instrumentation amplifiers. Capacitive sensors (simple and differential), pseudo-bridges. Photodetectors, current-to-voltage converters.

7. The front-end in signal acquisition.

Introduction. Voltage references. Switches, analogue multiplexers and applications. Sample and hold amplifiers.

8. Signals acquisition and distribution systems.

Concepts. Components in a signal acquisition and distribution system (SAD). Integrated SAD. Topologies in SAS. Topologies in a SDS. Acquisition boards and signal distribution: hardware, software and applications. Sources of error and calibration in signal acquisition. Instrumentation systems.

9. Laboratory

1 Measurements using digital multimeter.
2 Use and experimentation with the oscilloscope and the arbitrary function generator.
3 Electronic interface for a platinum based temperature sensor.
4 Load cell and instrumentation amplifier.
5 Electric current sensing technologies.
6 Control of electronic equipments using LabView.

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
Preparation of evaluation activities	11,00	0
Preparing lectures	21,00	0
Preparation of practical classes and problem	34,00	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 (CG3, CG4, CG6, CE2, CE6)

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 (CG3, CG4, CG6)

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 (CG3, CG4, CG6, CE6)

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 (CG3, CG4, CG6, CE2, CE5, CE6)

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 announcements 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 they must be separately equal or greater than 4.

Getting the theory mark (CG3, CG4, CG6, CE2, CE6)

• At the **first announcement**, the theory mark will be the result of:

1. A **written test** consisting of 4-5 practical issues related to the course contents and with similar difficulty to the issues and problems shown in class.

2. As a formative assessment, the student will deliver on the date specified by the teacher the **continuous tests** (CT). These tests must be sent to the teacher only in one PDF file before the date indicated. Other formats will be returned. Whatever CT not delivered will be computed as zero at the time to compute the $CT_{average}$.

As long as the mark of the written test is equal to or greater than 4, the theory mark will be obtained according to the following expression:

Theory = 0,8 x Written Test + 0,2 x CT's $_{average}$

If the mark of the written test is less than 4 this must be recovered at the 2nd announcement.

• At the **second announcement**, the theory mark will emerge as a result of:

A **written test** consisting of 4-5 practical issues related to the course contents and with similar difficulty to the issues and problems shown in class.

Thus the theory mark will be obtained according to the following expression:

Theory = Written Test

It is recalled that both in the first and second calls, in order to make an average of the theory and laboratory marks, it will be necessary for the mark of each of them separately to be equal to or greater than 4. The learning of the theory and the laboratory parts will be evaluated with a weight on the final grade of 60% and 40% respectively.

Getting the laboratory mark (CG3, CG4, CG6, CE2, CE5, CE6)

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. It will not be enter to the lab if they have not been made previously.

• At the **first anouncement** the laboratory mark will be the result of the two following assessments:

1. A mark obtained from the experimental activities and additional questions proposed in each experience (EA), with a wheight of 60%. It will assess the demonstrated skill, interest in the assembly, the domain in the use of laboratory equipment and development of practice throughout the session.

2. A mark obtained from the experimental activities and additional questions proposed in each experience (AP). They must be returned before the date proposed by the teacher. It will be mainly considered the organization and capacity of the student to work in group, the clarity of presentation and designs made. This will score 40% of the laboratory mark.

Thus the laboratory mark will be obtained according to the following expression:

Laboratory = 0,6 x EA + 0,4 x AP

• At the **second anouncement**:

1. The student must submit solved all the proposed designs, off-line and complementary activities (PD). They will be the 40% of the working laboratory mark.

2. At the official lab announcement date the student will have 3 hours to perform the experimental setup and adjustment of a proposed circuit (PC). This part will be a 60% of the laboratory mark.

Thus, the final laboratory mark will be obtained by the expression:

Laboratory = 0,4 x PD + 0,6 x PC

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

Subject = 0,6 x Theory + 0,4 x Laboratory

In any case the evaluation will be submitted to the statements of Reglament d'avaluació i qualificació de la Universitat de València per a títols de Grau i Màster (https://www.uv.es/uvweb/universitat/ca/estudis-grau/informacio-academica-administrativa/normatives/normatives-universitat-valencia-1285850677111.html).

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