VNIVERSITAT DE VALÈNCIA

Course Guide
34810 Instrumentation and Electronic Equipment

COURSE DATA

Data Subject	
Code	34810
Name	Instrumentation and Electronic Equipment
Cycle	Grade
ECTS Credits	6.0
Academic year	2018 - 2019

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
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

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

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 Digital multimeter measurements.
2 The arbitrary function generator HP33220A.
3 Design and verification of signal generating circuits.
4 Measurements with the oscilloscope and high-impedance passive probes.
5 Load cell and integrated instrumentation amplifier.
6 Sensing and conditioning temperature by platinum resistance thermometer.
7 Pressure measurement by a piezoresistive sensor and instrumentation amplifier.

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 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 (G3, G4, G5, G6, G9, TE3, TE8)

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

1. A **written exam** consisting of four or five practical issues related to the course contents and with similar difficulty to the issues and problems done 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 only in one PDF file to the teacher before the date indicated. Other formats will be returned. Whatever CT not delivered will be computed as zero at the time to compute the $CT_{average}$.

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

$$Mark_{theory}=0,8 \times Mark_{Written\ exam} + 0,2 \times CTs_{average}$$

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

1. A **written exam** consisting of four or five practical issues related to the course contents and with similar difficulty to the issues and problems done in class.

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

$$Mark_{theory}= Mark_{Written\ exam}$$

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

Note: Attendance to laboratory classes is compulsory and in anay 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 three following assessments:

1. Score of the Experimental Practice (GPE), with a wheight of 40% of the working laboratory. It will assess the skill demonstrated, interest in the assembly, the domain in the use of laboratory equipment and development of practice throughout the session. The score of the Experimental Practices will be delivered by groups of two.

2. Score from the additional questions and reports (M) that the teacher has asked each of the groups. The reports or results may be well arranged at any time during the academic year, so it is recommended that each student has a lab notebook, since students must deliver in the same session as the teacher requires them. Be valued mainly the organization and capacity of the student group work, clarity of presentation and designs made. This note will score 30% of the working laboratory.

3. Mark (E) obtained in a practical assembly that will be carried out in the last lab session. This note will score 40% of the working laboratory.This note will score 30% of the working laboratory.

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

$$Mark_{Lab} =0,4 \times GPE + 0,3 \times M + 0,3 \times E$$

At the **second anouncement:**

- The student must submit the lab exercices and designs solved (GP). They will be the 40% of the working laboratory mark.

- In the official lab announcement date the student will have 3 hours to perform the experimental setup and adjustment of a proposed circuit (ME). This part will be a 60% of the working laboratory.

Thus, the laboratory score will be obtained by the expression:

$$Mark_{Lab} = 0{,}4 \times GP + 0{,}6 \times ME$$

If any of the parts (Theory or Laboratory) has a grade lower than 4 it will not give rise to averaging. 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:

$$Mark_{Subject} = 0{,}6 \times Mark_{Theory} + 0{,}4 \times Mark_{Lab}$$

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://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639).

REFERENCES

Basic

- 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

- 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.
- Pérez, M.A.; Álvarez, J.C.; Campos, J. C.; Ferrero, F.J.; Grillo, G.J.: Instrumentación Electrónica. Ed. Thomson, Madrid, 2003. Formato electrónico: Trobes (CI CD 621.3 INS)
- Pallás Areny, R., Webster, J. G.: Sensors and signal conditioning, New York : J. Wiley and Sons, c2001, web isbn: 0-471332-32-1. Referencia equivalente a la nº [b3] pero en formato electrónico.