VNIVERSITAT DE VALÈNCIA

Course Guide
34811 Measurement Equipments and Systems

COURSE DATA

Data Subject	
Code	34811
Name	Measurement Equipments and Systems
Cycle	Grade
ECTS Credits	6.0
Academic year	2016 - 2017

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
CASANS BERGA, SILVIA	242 - Electronic Engineering
NAVARRO ANTON, ASUNCION EDITH	242 - Electronic Engineering

SUMMARY

The purpose of this course is to describe the acquisition systems and signal distribution, hardware and software that configures a virtual instrumentation system and some acquisition cards.

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.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

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.
- 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.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

RA-1. Be able to perform basic electronic equipment measurements relating to the accuracy limitations of the measuring system.

• 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.

• RA-3. Ability to apply the appropriate electronic conditioning for measuring certain variable by using a specific sensor.

• RA-4. Being able to propose valid solutions to new problems of sensing and signal conditioning.

• RA-5. Ability to develop and control electronic engineering systems oriented to test and measurement.

• RA-6. Be able to perform low-level measurements using specific electronic equipment.

DESCRIPTION OF CONTENTS

1. 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.

2. Voltage reference.

Voltage References: technical specifications, technologies, applications and current references.

3. Switches and Multiplexers.

Analog Switches: Technical Specifications, types and functions.
Analog multiplexers: Technical Specifications, static and dynamic errors, speed and multiplexing applications.

4. Sample and hold amplifiers.

Sample and hold amplifiers: Component parts and operation errors and dynamic and static applications.

5. Instrumentation systems.

Introduction: Objectives and topologies of an instrumentation systems. Device control through IEEE-488 bus.Device control through the USB bus. Acquisition and distribution of signals by the USB bus.

6. Electronic equipment: Meters for low level signals and the spectrum analyzer.

Measures low-level signals measurements. Electronic equipment for measuring low-level signals. Basic electronic circuits and dedicated equipments. Cases of application.
Spectral analysis. Basics. Superheterodyne analyzers.

7. Laboratory sessions

LabVIEW: Introduction to graphical programming environment. System for data acquisition via USB: NI USB - 6008. Weighing system with electronic load cell with integrated instrumentation amplifier . Design of a virtual instrument for calibration and acquisition of the signal from a load cell.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	30,00	100
Development of group work	18,00	0
Preparation of evaluation activities	14,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	43,00	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

With respect to group learning with the teacher (sessions of theory and problems), use the lecture model. 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

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 are voluntary and must be resolved exclusively by the students without any help from the teacher.

Laboratory sessions

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.

Problem 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 must be separately equal or greater than 4. .

Getting the theory mark

In both announcements, the theory mark will emerge as a result of:

1. A written exam consisting in 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 be able to deliver on the date specified by the teacher the continuous tests (CT). These tests must be submitted in PDF format only the teacher before the date indicated or deliver resolutions manuscript. In order to contribute for the final theory mark the average tests mark must be equal or greater than 4 and students present at least 50% of the PECS proposed. In this case, this average value will contribute to a 10% of the total theory score.

3. Along the semester the students have to do 3 in-person test (PG) (30-60 minutes long) as part of the continuous assessment system. This test will be solved in working groups, at most 3 students. The groups will be established at the begging of the course (first two weeks), afterwards changes are not allowed. If any member of the group is invited to leave it by the other members, this student will have to do all the tests by himself/herself and its contribution to the final mark will be 10%.

Thus, the theory mark is obtained according to the following expression:

if CTavg>=4 then Marktheory= 0,8Written Exam + 0,1PG+0,1 x CTavg

else (CTavg <4) then Marktheory = 0,8Written Exam+0,1PG

Getting the laboratory mark

Note: Depending on the characteristics of the practice it is required, prior to entry in the laboratory to do certain calculations and designs necessary for the realization of the experience. It will not be enter to the lab if they have not been previously.

The laboratory note emerge from the three following assessments:

1. Score of the Experimental Practice (GPE), which scored 20% of the working laboratory. It assessed 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. "S" is the mark assigned to the software demanded by the lecturer. The software developed can be evaluated at any time during the semester, in the same session the lecturer asks for it. The mark will be focused on work ability, organization, user friendly interface and design. The score of this part is 30%

3. Note (E) obtained in the realization of a written examination to be held in the official announcement indicated in the official calendar of exams. This note will score 50% of the working laboratory.

Thus laboratory mark is obtained according to the following expression:

MarkLab=0.2 x GPE + 0.3 x S + 0.4 x E

As long as each party is assigned a score greater than 4.

If the student fails the Laboratory or have not followed this on going evaluation (did not attend the lab sessions) they must:

- Submit the lab exercises and designs solved (GP). They will be the 40% of the working laboratory mark.

- 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:

MarkLab=0.4 x GP + 0.6 x ME

The final mark of the subject, provided the theory and lab marks are equal or greater than 4, is obtained according to the following expression:

MarkSubject=0.6 x MarkTheory + 0.4 x MarkLab

REFERENCES

Basic

- Pallàs Areny, R., "Adquisición y distribución de señales", Ed. Marcombo, Barcelona, 2005.
- Franco, S. "Diseño con amplificadores operacionales y circuitos integrados analógicos", 3ª Ed. McGraw-Hill, 2004.
- Pérez, M.A.; Álvarez, J.C; "Instrumentación Electrónica", Ed. Thomson, 2004.

- M.A. Pérez Garcia, "Instrumentación electronica 230 problemas resueltos, 4ª Ed. Garceta, 2012.
- Morris, Alan S., Principios de mediciones e instrumentación, Ed. Prentice Hall, 2002.