VNIVERSITAT DE VALÈNCIA

COURSE DATA

Data Subject	
Code	43852
Name	Advanced instrumentation and measurement systems
Cycle	Master's degree
ECTS Credits	5.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2174 - Master's Degree in Telecommunications Engineering	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2174 - Master's Degree in Telecommunications Engineering	6 - Advanced instrumentation and measurement systems	Obligatory

Coordination

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

SUMMARY

Advanced instrumentation and measurement systems (SIMA) is given in the Master in Telecommunications Engineering in the first semester of the first year. SIMA is a 5 ECTS subject that belongs to the Basics of Electronic Technology and Terminals (TET).

The purpose of SIMA is the skills acquisition in the use of measurement systems and smart sensors with different complexity. This subject introduce the theoretical concepts necessaries to understand the concept of measurement system, intelligent sensor and the technological consequences when the measurement system, design and/or control, is applied to real applications. Likewise, SIMA shows the techniques for the design and test of electronic and virtual instruments. Laboratory sessions will reinforce the skills and abilities in the use of these systems.

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 mathematical analysis and calculus, analysis of circuits and linear systems, and analog and digital components and circuits.

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

2174 - Master's Degree in Telecommunications Engineering

- To have the ability of standing up for fair criteria with rigor and arguments, reporting them publicly in a clear way and in a multilingual environment.
- To have the ability to participate in diffusion forums, journals, conferences, etc. and to work cooperatively and effectively in transnational teams.
- To have the capability to identify and solve the critical points to conduct an effective technology transfer, transforming theoretical results into products and services that are useful for the society.
- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Be able to access to information tools in other areas of knowledge and use them properly.
- To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.
- Ability to develop electronic instrumentation, as well as transducers, actuators and sensors.

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

At the end of the semester the student should be able to:

- Specify and use electronic instrumentation and measurement systems
- Take measurements with electronic instruments relating its limitations with the accuracy of the measurement system.
- Determine the contribution to the measurement system accuracy of the different measurement system blocks.
- Apply the proper electronic conditioning for the measurement of certain variable using a specific

sensor.

- Offer valid solutions to new problems on sensing and signal conditioning.
- Set up a system of industrial instrumentation
- Design and implement a system of industrial instrumentation
- Design and implement a virtual instrumentation system

DESCRIPTION OF CONTENTS

1. Measurement sytems

Standard measurements systems: Analysis and error minimization.

2. Sensors and conditioning circuits

Sensors, transductors and actuators. Signal adaptors and sensor conditioning, amplifiers, converters, isolating amplifiers, linearization systems, Sample-and Hold systems, filters, A/D and D/A converters, Sigma-Delta converters, instrumentations special configurations (blocking amplifier, synchronous detection, Boxcar, etc.). Interferences. Intelligent sensor bases. Microsensors. Intelligent measurement distribution and application. Mixed processing techniques applied to intelligent sensors.

3. Distributed measurements systems

Intelligent sensor networks: topologies and examples. Instrumentation systems: basic and networked. Design and set-up of electronic and virtual instruments. Introduction to measurement automation.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	26,00	100
Laboratory practices	16,00	100
Seminars	4,00	100
Tutorials	4,00	100
Development of group work	10,00	0
Study and independent work	7,00	0
Readings supplementary material	3,00	0
Preparation of evaluation activities	15,00	0
Preparing lectures	17,00	0
Preparation of practical classes and problem	13,00	0
Resolution of case studies	10,00	0
TOTAL	**125,00**	

TEACHING METHODOLOGY

The learning strategy comprehends a range of different activities:

a) MD1.- Lectures. Lectures will be master class. The lectures will develop the subjects in a progressive manner, building on existing knowledge whilst introducing new material in a well-paced manner, emphasizing the most important elements, their relevance for academia and industry. Student participation, being fundamental for the transfer of knowledge during lecture hours, will be actively sought.

b) MD2.- Homework. These assignments complement the lectures, allowing the students to apply the concepts and tools learnt in the lectures, as well as their own readings. Team collaboration is encouraged for the solution of assignments. It might cover different activities:

- specific problem solving sessions,
- discussion sessions,
  - laboratory sessions.

c) Personal work. This autonomous task involves preparation of material before the lectures, for the assignments, as well as for the exam.

d) Working groups: Team collaboration is encouraged for the solution of assignments. This autonomous task involves preparation of laboratory sessions, for the assignments, as well as for the exam.

e) Grading. Grading will take into account attendance to the lectures, assignments, exam or exams, and presentation to the class of a research problem.

f) Schedul Tutorials (individual or in group). The students have a tutorial timetable to solve problems, doubts, work orientation, etc. The tutorial timetable is set at the beginning of the academic course.

UV’s e-learning platforms (Aula Virtual) will be used to communicate with students. They will also provide access to the material used in the lectures, such as slides, and to the homework assignments.

EVALUATION

The performance of the student will be assessed along the course with a continuous assessment or Single assessment system. In both cases the theory-problems rate is the 60% of the final mark and laboratory rate is the 40% in the final mark, being indispensable a punctuation of 4 over 10 in each part.

In order to adhere to the continuous assessment option the student must attend at least 80% of the lectures, compete at least 80% of the proposed activities.

Evaluation method:

- SE1.- To evaluate the theory-problems will be an exam. This **exam** rate is **50%** of the final mark.
- SE3.- Questions proposed have a **10%** rate.
- SE2.- The laboratory performance will be assessed every session. In each session the skills, dedication, and results obtained will be evaluated by the instructor. Additionally, the instructor may request the elaboration of one or several reports. The assessment takes into account the previous preparatory actions of the students, as well as the skills shown in the execution plus the reports requested. The laboratory sessions have a **20%** rate, the other **20%** corresponds to a final project.

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

- R. Pallás Areny: "Sensores y acondicionadores de señal", 2ª ed. Marcombo, Barcelona 1994
- R. Pallás Areny, J. G. Webster: "Analog signal processing", Wiley Interscience, NY, 1999
- Pallás Areny, R.: "Adquisición y distribución de señales". Marcombo, Barcelona 1993.
- R. Pallás Areny, F. Reverter: "Circuitos de interfaz directa sensor microcontrolador", Marcombo, Barcelona, 2008
- S. Franco: Diseño con amplificadores operacionales y circuitos integrados analógicos, 3ª ed. McGraw-Hill, 2005
- Jeffrey Y. Beyon: LabVIEW programming, data adquisition and analysis. Ed. Prentice Hall PTR.

Additional

- N. V. Kirianaki, S. Y. Yurish, N. O. Shpak, V. P. Deynega:" Data acquisition and signal processing for smart sensors", John Wiley & Sons, NY, 2002
- Chapman & Hall, Boca Raton: "Distributed sensor networks", S. Sitharama (Ed.), R. R. Brooks (Ed.) 2005
- Rick Bitter, Taqi Mohiuddin, Matt Nawrocki: LabVIEW Advance Programming Techniques, CRC Press. ISBN0-8493-2049-6.
- A. M. Làzaro, D. Biel Solé, J. Olivé Duran, J. Prat Tasias, F. J. Sànchez Robert: Instrumentació virtual, Adquisició, processament i anàlisi de senyals. Edicions UPC.

- Hall T. Martin, Meg L. Martin: LabVIEW for automatitations, semiconductor, biomedical, and other applications. Ed. Prentice Hall PTR
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