COURSE DATA

DATA SUBJECT

Code: 44288
Name: Electronic interfaces for sensors
Cycle: Master's Degree
ECTS Credits: 3.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2199 - Master's Degree in Electronic Engineering	Escola Tècnica Superior d'Enginyeria	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2199 - Master's Degree in Electronic Engineering	Industrial electronic	COMPULSORY

COORDINATION

CASANS BERGA SILVIA

SUMMARY

The purpose of this course is to describe the most common sensing and signal conditioning subsystems as well as the mechanisms of error production in a conventional measurement system and how to reduce them. The topology of a conventional measuring and acquisition system will provide a basis for presenting the concept of smart sensor, their topologies and their processing techniques. From a practical point of view the goal is to gain experience in the use of different types of sensors and electronic interfaces.

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 and circuits.

COMPETENCES / LEARNING OUTCOMES

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Ability to specify, implement, document and set-up electronics, instrumentation and control equipment and systems, considering both technical aspects and the relevant regulatory requirements.

Capacidad para el modelado matemático, cálculo y simulación en todos los ámbitos relacionados con la Ingeniería Electrónica y campos multidisciplinares afines. En especial los de tratamiento de la señal, sistemas digitales y de comunicaciones y electrónica industrial.

Capacidad para proyectar, calcular y diseñar productos, procesos e instalaciones en todos los ámbitos de la Ingeniería Electrónica y en particular los de tratamiento de la señal, sistemas digitales y de comunicaciones y electrónica industrial.

Demostrar una comprensión sistemática de un campo de estudio y el dominio de las habilidades.

Diseñar un sistema, componente o proceso que cumpla unas especificaciones desde diferentes puntos de vista: electrónico, económico, social, ético y medioambiental.

Identificar, formular y resolver problemas de los sistemas electrónicos industriales.

Realizar un análisis crítico, evaluación y síntesis de ideas nuevas y complejas.

Ser capaz de fomentar, en contextos académicos y profesionales, el avance tecnológico, social o cultural dentro de una sociedad basada en el conocimiento.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

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.

Take into account the economic and social context in engineering solutions, be aware of diversity and multiculturalism and ensure sustainability and respect for human rights and equality between men and women.

DESCRIPTION OF CONTENTS

1.
Resistive sensors and their conditioners

Introduction
Strain gauges
Temperature Detectors (RTD)
Thermistors
Signal types
The Wheatstone Bridge
Differential and instrumentation amplifiers

2. Variable reactance sensors and their conditioners

Introduction
Capacitive sensors
Inductive sensors
Pseudobridges and AC amplifiers
Carrier amplifiers and synchronous detection

3. Sensor generators and their conditioners

Introduction
Thermoelectric sensors: thermocouples
Amplifiers with low imbalances and drifts

4. Measurement systems: Error analysis and reduction

Introduction
Sources of error in analog signal processing
Error reduction using internal calibration

5.

6.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	20,00
Laboratory	15,00
Total hours	**35,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	0,00
Preparation of lessons	32,00
Preparation for assessment activities	10,50
Resolution of case studies	0,00
Total hours	**52,50**

TEACHING METHODOLOGY

The development of the course is structured around four themes: the theory sessions, problems, tutorials, submision of deliverables and presentation of practices technical documentation.

Group learning with the teacher

In the theory sessions lecture model will be used. In them, the teacher will present the basic content of the course using the audiovisual means available (presentations, transparencies, blackboard). In the practical sessions the teacher will explain a number of problem-type, through which students will learn to identify the essential elements of the approach and problems resolution. Participatory method for these sessions, which are intended to prevail communication between students and students / teacher will also be used. To do this, the teacher previously indicate which day you will devote to solving problems and what problems could be solved, so that the student will attend classes with the approach of these problems prepared in advance. Its resolution will be completed in class in groups of four or five students who must then come to the board to explain the problem and resolve the doubts.

Tutorial time

The students will have a schedule of tutoring aimed to solve the problems, doubts, guidance papers, etc.. The schedule of these tutorials will be indicated in the beginning of the academic year. They will also have the opportunity to clarify some questions via email or discussion forums by using the "Aula Virtual" platform.

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

Laboratory sessions will be organized around groups formed by a maximum of two people who should be planned for the design, installation and tdoing experimental tests. Each practice will consist of two distinct parts. The first part is theoretical and its resolution is required to perform the experimental second part.

Teaching materials

The student will have in the Aula Virtual platform 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 of the course topics.

Problems of each lesson.

Continuous Tests (PECs) of each lesson.

The script of laboratory practices.

EVALUATION

The evaluation of the subject will consist of a written test, with theoretical and practical questions, and laboratory.

REFERENCES

- 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.
- 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.

- S. Sitharama (Ed.), R. R. Brooks (Ed.): "Distributed sensor networks", Chapman & Hall, Boca Raton, 2005.