COURSE DATA

DATA SUBJECT

Code: 46798
Name: Physical-Biomedical Sensors and Instrumentation
Cycle: Doctorate / Master's Degree
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2269 - Master's Degree in Electronic Engineering	Escola Tècnica Superior d'Enginyeria	1	First quarter
3131 - PhD in Electronic Engineering	Escola de Doctorat		First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2269 - Master's Degree in Electronic Engineering 3131 - PhD in Electronic Engineering	Diseño Electrónico	COMPULSORY

COORDINATION

DEL CANTO SERRANO IRENE
CASANS BERGA SILVIA

SUMMARY

The subject shows the fundamental subsystems of sensing, electronic conditioning and signal transmission present in an electronic measurement system. Likewise, the theoretical contents necessary to acquire a fundamental overview of the concept of intelligent sensors and the techniques used in the processing of physical-biomedical measurements are presented.

From a practical point of view, the aim 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 very convenient that students have knowledge of mathematical analysis and calculation, analysis of circuits and linear systems, analog and digital components and circuits.

COMPETENCES / LEARNING OUTCOMES

2269 - Master's Degree in Electronic Engineering

Conduct a critical analysis, evaluation and synthesis of new ideas to solve problems in complex or unfamiliar environments within broader contexts in the field of electronic engineering and related multidisciplinary fields.

Create mathematical models and simulations in the field of electronic engineering and related multidisciplinary fields.

Demonstrate a systematic knowledge and a mastery of technical, personal, social and methodological skills in the field of electronic engineering and related multidisciplinary fields.

Design systems and processes that meet electronic, regulatory, economic, social, ethical and environmental specifications.

Gain the professional skills and cooperation abilities that are suitable for practising in the field of electronic engineering and related multidisciplinary fields.

Handle specialised software and hardware, as well as design, simulation and programming environments in the field of electronic engineering and related multidisciplinary fields.

Identify, formulate and solve problems in the field of electronic engineering and related multidisciplinary fields.

Interpret technical documentation and regulatory standards for equipment and systems in the field of electronic engineering and related multidisciplinary fields.

Know advanced techniques of instrumentation and design of electronic, photonic and microelectronic devices.

Project, calculate and design products, processes and installations in the field of electronic engineering and related multidisciplinary fields.

DESCRIPTION OF CONTENTS

1. Fundamentals of measurement systems

Introduction, sources of error, static and dynamic characteristics, calibration methods, signal transmission.

2. Sensors of physical variables and signal conditioning

Introduction, sensors of physical variables, electronic conditioning of resistive sensors, electronic conditioning of variable reactance sensors, electronic conditioning of generator sensors.

3. Smart sensors

Introduction, quasi-digital sensors, direct sensor-microcontroller interfaces, calibration techniques.

4. Concepts of biomedical instrumentation

Types of biomedical signals, characteristics of biosensors, direct and indirect measurement techniques.

5. Bioelectric signal acquisition and conditioning systems

Characteristics of biopotentials, electrodes, sources of noise and interference, compensation techniques, criteria and design process.

6. Electrical safety

Harmful effects of electric current, susceptibility parameters and risk modeling, electrical safety of measurement equipment, isolated amplification systems, regulations.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	35,00
Laboratory	25,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Individual or group project	15,00
Independent study and work	20,00
Preparation of lessons	35,00
Preparation for assessment activities	20,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the subject is structured around three axes: the theory and problem sessions, the tutorials and the presentation of technical documentation with the tests carried out in the laboratory.

Group learning with the teacher: The master lesson model will be used in the theory sessions. During them, the teacher will present the fundamental contents of the subject. In the practical sessions, the teacher will explain a series of typical problems, thanks to which the student will learn to identify the essential elements of the approach and resolution of the problems.

Tutorials: Students will have a tutorial schedule whose purpose is to resolve problems, doubts, guidance on work, etc. The schedule of these tutorials will be indicated at the beginning of the academic year. In addition, they will have the opportunity to clarify some doubts through email or discussion forums using the "Virtual Classroom" tool, provided by the University of Valencia.

Group work with colleagues: The laboratory sessions will be organized around groups made up of a maximum of two people who must be planned to carry out the design, assembly and different experimental tests. Each practice will be made up of two very different parts. The first part is theoretical in nature and its resolution is mandatory in order to carry out the second part, which is exclusively experimental in nature.

Available teaching materials: In order to successfully carry out the described teaching methodology, the student will have the transparencies and practice scripts available in the Virtual Classroom.

EVALUATION

Both in the first and second call, the grade for the subject will be the result, with the same weight, of:

1. (SE1) The completion of a written test on the dates indicated in the official calendar. The exam will consist of various questions with difficulty similar to the questions and problems asked in class.

2. (SE2) The evaluation of the practical sessions will be carried out by solving a practical case in the laboratory.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

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

REFERENCES

- - R. Pallás Areny: "Sensores y acondicionadores de señal", 2ª ed. Marcombo, Barcelona. - R. Pallás Areny, J. G. Webster: "Analog signal processing", Wiley Interscience, NY. - R. Pallás Areny.: "Adquisición y distribución de señales". Marcombo, Barcelona. - R. Pallás Areny, F. Reverter: "Circuitos de interfaz directa sensor microcontrolador", Marcombo, Barcelona. - N. V. Kirianaki, S. Y. Yurish, N. O. Shpak, V. P. Deynega:" Data acquisition and signal processing for smart sensors", John Wiley & Sons, NY. - S. Sitharama (Ed.), R. R. Brooks (Ed.): "Distributed sensor networks", Chapman & Hall, Boca Raton. - J. G. Webster: Medical instrumentation: application and design, John Wiley & Sons, NY. - L. Cromwell, E. A. Pfeiffer, F. J. Weibell: Biomedical instrumentation and measurements, Prentice Hall, Londres. - R. A. Normann: Principles of bioinstrumentation, John Wiley & Sons, NY.