Universidad Zaragoza

Academic Year/course: 2024/25

60036 - Intelligent Instrumentation

Syllabus Information

Academic year: 2024/25
Subject: 60036 - Intelligent Instrumentation
Faculty / School: 100 - Facultad de Ciencias
Degree: 538 - Master's in Physics and Physical Technologies
589 - Master's in Physics and Physical Technologies
ECTS: 5.0
Year: 1
Semester: First semester
Subject type: Optional
Module:

1. General information

Intelligent Instrumentation is recommended for students who wish to pursue their professional or scientific activity in any of the fields of experimental physics, working in laboratories with physical measurements, calibration and characterization of materials and in general those centres where acquisition and measurement systems are used. In this subject, students will become familiar with modern techniques for the acquisition and processing of physical measurements, especially those that require specific instrumentation or high-performance analogue and digital processing and conditioning techniques, designed for their application to measurements at the physical limit of resolution.

2. Learning results

Upon completion of the subject, students will be able to:

Analyse specific precision electronic interfaces (low noise, high sensitivity, etc.).

Apply analogue signal processing techniques to the design of physical transducer interfaces.

Design an analogue signal conditioning circuit for a given specification.

Program a multi-instrument measurement acquisition environment.

Select the most suitable digital algorithm to remove electrical noise from the signals.

Design a simple automatic control system.

The interdisciplinary nature of this subject and the transversal nature of its contents make it especially relevant for any student of the Physics degree, regardless of the curricular itinerary chosen.

3. Syllabus

1. Electrical modelling of physical sensors.
2. Specialized electronic interfaces: low current, high resistance, low noise, etc.
3. Analog signal processing: linear and nonlinear.
4. Digital and quasi-digital conversion techniques.
5. Digital signal processing.
6. High performance electronic instrumentation: SMU, electrometer, etc.
7. Standard instrumentation buses.
8. Instrument calibration.
9. Automatic process control and remote laboratories.

4. Academic activities

Lectures on the main topics of the subject.

Individual and/or small group work of thematic works and problems related to the contents of the subject.

Presentation and discussion in class of thematic works and problems.

Laboratory practices, leading to the design and characterization of a complete measurement acquisition and instrumentation control system.

5. Assessment system

Continuous assessment of the students' learning through the solving of questions, problems and proposed thematic works, their

delivery on the established deadlines and the possible presentation in class (50%). Up to 5 points can be obtained with this part. A grade lower than 2.5 points will result in the obligation to do compensatory work or the writing of the single global test.

Laboratory practice (50%): the grade will be based on the continuous assessment of the attitude and skills demonstrated by the student in their development and the grade given to the report of each of the proposed experiences submitted within the deadlines set. The report will describe precisely the proposed objectives, methodology used and results obtained, as well as the answers to the questions posed. Up to 5 points can be obtained with this part. A grade lower than 2.5 points will result in the obligation to do compensatory work or the writing of the single global test.

The student who has not passed the subject by means of the proposed activities may opt for the development of compensatory work of equivalent dedication or the completion of a theoretical test (50%) - practical (50%), on the date established by the official calendar of exams.

6. Sustainable Development Goals

4 - Quality Education
8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure