Universidad Zaragoza

Academic Year/course: 2021/22

39627 - Electronic Instruments

Syllabus Information

Academic Year: 2021/22
Subject: 39627 - Electronic Instruments
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 608 -
ECTS: 6.0
Year: 3
Semester: Second semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The main goal of the Electronic Instrumentation course is to train the student in the theoretical and practical concepts of all the blocks that are part of the measurement of a physical variable integrated as part of a measurement system.

The subject and its expected results respond to the following approaches and goals:

- Know how to develop the essential blocks that make up a measurement system of a certain physical variable, and the classification of the Instrumentation systems, according to the measurement type.
- Know how to apply mathematical knowledge to calibrate and calculate measurement errors
- Acquire knowledge about the different types of most frequently used sensors.
- Distinguish the technological, structural and functional characteristics to be able to choose the sensor type, signal conditioning circuits, acquisition system and the most suitable signal processing, to obtain a certain solution.
- Learn about the principles of data conversion between the analog and digital domain.
- Encourage students to develop real application projects.

1.2. Context and importance of this course in the degree

Each subject of the degree, tries to cover a field in the Technological and Scientific formation of the student. Electronic instrumentation creates the base of knowledge in measurement and monitoring systems that make up one of the major parts of the current mechatronic systems and implies a sizeable impact on the acquisition of the competences of the degree. For this reason, it is reinforced in the fourth year with an optional subject called Advanced Instrumentation, in order to provide useful additional training in the performance of the Mechatronic Engineer's functions related to the field of electronic instrumentation and control.

1.3. Recommendations to take this course

There is no prior requirement to take this subject. Nevertheless, the contents to be studied will require the abilities and skills acquired, mainly, in the subjects of Basic Physics II, Computer Science, Electrical Engineering and Electronic Technology I.

2. Learning goals

2.1. Competences

As generic and specific competences the student will acquire:

- GI04: Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, abilities and skills in the field of Industrial Engineering and in particular in the field of industrial electronics.
- GC02: Interpret experimental data, contrast them with the theoretical ones and draw conclusions.
- GC03: Ability for abstraction and logical thinking.

- GC08: Ability to locate technical information, as well as its understanding and evaluation.
- GC14: Ability to understand the operation and develop maintenance of mechanical, electrical and electronic equipment and installations.
- GC16: Ability to set up, simulate, build and test prototypes of electronic and mechanical systems.
- EI05: Knowledge of the basics of electronics.
- EE02: Knowledge of the basics and applications of analog electronics.
- EE04: Ability to design analog and digital electronic systems.
- EE08: Applied knowledge of electronic instrumentation.

2.2. Learning goals

1. Apply the basic principles of measurement.

2. Be able to explain the meaning of terms such as transducer, sensor, actuator, magnitude to measure, sensitivity, linearity, interval of use, precision, error and bandwidth.

3. Know how to design the most relevant applications of instrumentation systems.

4. Be familiar with the operation and features of a wide variety of sensors, with increased focus on those that are frequently used in industrial facilities.

5. Be able to classify this variety of sensors according to the measured magnitude or the variable parameter.

6. Develop possible applications and know how to decide which one the most appropriate for each case would be.

7. Know how to select the appropriate signal conditioning for the different types of sensors.

8. Learn about the different shapes of input and output signals associated with the different transducers, as well as evaluate the need for electronic signal processing that allows it to interface with the measuring equipment.

9. Design different instrumentation systems as part of a programmable embedded system based on microprocessor.

2.3. Importance of learning goals

This course has a clear engineering nature, that is, it offers training with application content and immediate development in the labor and professional market. Through the achievement of the relevant learning outcomes the necessary capacity is obtained for the understanding of the operation of the essential blocks that make up a measurement system of a certain physical variable, which will be absolutely essential for the design and start up of any application, plant, process, etc. included within the scope of Mechatronic Engineering.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Continuous assessment.

The student must demonstrate that they have achieved the expected learning outcomes by the assessment of the following activities:

- Laboratory Practice Activities: In each of the practice activities the results obtained and the process followed will be evaluated. Once the practice tasks have been completed, a report must be produced. This activity is valued from 0 to 10 points and students must get a minimum score of 4 points in each one to make an average.

- Written assessment tests and posed works: The assessment test may include theoretical questions, problems to be solved and theoretical-practical questions. The posed works may replace the examination of part of the course in the continuous assessment method. These activities will be valued from 0 to 10 points and a minimum score of 4 points in each of them to make an average.

Assessment activity	Weighting
Laboratory practice activities	60%
Written assessment tests and posed works	40%

To opt for the Continuous Assessment system, at least 80% of the classroom classes (practical, technical visits, classes, etc.) must be attended

Global assessment test.

Following the regulations of the University of Zaragoza in this regard, in courses that offer continuous assessment, a global evaluation test will be scheduled for those students who decide to opt for this second system.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

1. Lectures: The theoretical concepts of the subject are explained and illustrative examples are developed as a support to the theory when necessary, focus on calculation, design and development of a mechatronic system

2. Laboratory Workshop. These classes are highly recommended for a better understanding of the concepts because those items whose calculation is done in theory classes are shown in working mode.

3. Tutorials related to any concept of the subject. This activity is developed in an on-site mode with a defined schedule or through the messaging and forum of the Moodle virtual classroom.

If classroom teaching were not posssible due to health reasons, it would be carried out on-line.

4.2. Learning tasks

The course includes the following learning tasks:

- Lectures. They will take up 2 hours per week till the 40 hours, necessary to accomplish the objectives of the subject study, are reached
- Laboratory Workshop. It will take up 10 sessions of 2 hours duration. The group is divided up into various groups, according to the laboratory capacity.
- Autonomous work and study. This off-site part is equivalent to 90 hours, necessary for the study of theory, problem solving and revision of documents
- Individual tutorials. Each teacher will publish a schedule of attention to the students throughout the four-month period

4.3. Syllabus

The contents are distributed in seven teaching units (See table below). These units include the contents needed for the acquisition of predetermined learning outcomes.

Unit I	Introduction to instrumentation systems.
Unit II	Signal conditioning circuits.
Unit III	Temperature Measurement.
Unit IV	Position, displacement and velocity Measurement.
Unit V	Strain, strength, weight and torque Measurement
Unit VI	Acceleration, vibration and shock Measurement.
Unit VII	Flow, level and pressure of fluids Measurement

4.4. Course planning and calendar

The dates of the final exams will be those that are officially posted on https://eupla.unizar.es/asuntos-academicos/examenes.

In continuous assessment methodology, the students must deliver several partial works and a final work whose schedule will be defined during the course.

The final dates will be published in the digital platform (Moodle)

The overall test for not continuous evaluation system will be set at the end of the semester and will consist of a written test based on theoretical arguments and problems of all topics covered in class.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28827

Material	Medium
Syllabus theory notes Additional syllabus information	Paper/repository
Syllabus theory notes Syllabus presentations	Digital/Moodle E-Mail

Useful links	
technical information	Paper/repository Digital/Moodle