Universidad Zaragoza

Academic Year/course: 2021/22

28839 - Advanced Electronic Instrumentation

Syllabus Information

Academic Year: 2021/22
Subject: 28839 - Advanced Electronic Instrumentation
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 424 - Bachelor's Degree in Mechatronic Engineering
ECTS: 6.0
Year: 4
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The objective of the subject is to train the student in the theoretical and practical concepts of the data acquisition systems, digital processing and virtual instrumentation. The subject and its expected results respond to the following approaches and goals:

- Acquire knowledge about network instrumentation, card-based instrumentation, programming and Interconnection of Instruments.
- Differentiate the technological, structural and functional characteristics to be able to choose the sensor type, signal conditioning circuits, the most suitable signal acquisition and processing system to obtain a certain solution.
- Introduce the student into the management of advanced instruments.
- Set up the basics about the interference problem, and its treatment.
- Know how to develop the essential blocks that make up an intelligent instrumentation system.
- Encourage students to develop real application projects.

1.2. Context and importance of this course in the degree

The course of Advanced Instrumentation is part of the group of subjects that belong to the module called Electricity and Electronics. This optional subject complements the 3rd year subject Electronic Instrumentation, extending the contents in data acquisition, signal digital processing, communications between digital instruments and intelligent instrumentation.

1.3. Recommendations to take this course

There are no prior requirements to take this subject. Nevertheless, it is recommended that the student is in possession of the abilities and skills acquired, mainly, in the following subjects: Electronic Instrumentation, Electrical Engineering, Programmable Electronic Instrumentation, Electronic Technology I and Electronic Technology II.

2. Learning goals

2.1. Competences

- GI03: Knowledge of basic and technological subjects, enabling them to learn new methods and theories, and provide them with versatility to adapt to new situations.
- 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.
- 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. Know different types of sensors and transducers.
2. Understand and interpret commercial equipment documentation.
3. Preparation and interpretation of plans and diagrams according to the regulations and appropriate symbols.
4. Understand the blocks and circuits that make up the data acquisition cards.
5. Know how to choose the right card for each application.
6. Integrate different measurement systems.
7. Simulate, analyze, design and apply the elements with virtual instrumentation.
8. Use industrial communication protocols.
9. Understand the problems associated with electromagnetic noise and know how to deal with it.

2.3. Importance of learning goals

The aspects studied in this course enable the student to deal with electronic instrumentation projects, intelligent instrumentation and virtual instrumentation, widely used in the industrial world. In other words, it offers training with contents of application and immediate development in the labor and professional market. The skills acquired are essential for the design and start-up of any applications, plants, processes, systems, mechanisms etc. included within the field 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. This activity will be carried out individually.

- 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	50%
Written assessment tests and posed works	50%

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 focus on 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, focused 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 possible 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 30 hours, necessary to accomplish the objectives of the subject study, are reached

Laboratory Workshop. It will take up 15 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

Tutorials. Each teacher will announce a Student Tutorial Timetable throughout the four-month period.

4.3. Syllabus

The theoretical contents are distributed based on five teaching units (See the table below). The units include the necessary contents for the acquisition of the expected learning outcomes.

	Advanced instrumentation.
Unit 1	Data acquisition systems
Unit 2	Signal digital processing.
Unit 3	Instrumentation software.
Unit 4	Communication and instrumentation buses
Unit 5	Smart instrumentation

4.4. Course planning and calendar

In the continuous assessment mode, the delivery of several partial works and a final course work whose delivery dates will be defined during the course is mandatory.

The final dates will be published in the digital teaching network (Moodle).

The global assessment test will be held at the end of the semester and will consist of a written test on theoretical arguments and problems of all the topics explained in class. The dates of the two final exams will be those officially posted on https://eupla.unizar.es/asuntos-academicos/examenes

The class timetable will be found on the EUPLA website http://www.eupla.unizar.es/

In addition, students will have, at the beginning of the course, the dates and places of the exams necessary to pass this subject.

4.5. Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=28839&year=2020

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

Acquisition system NI USB-6008	Laboratory
LabView 2012 Software	Computer Lab
Matlab Simulink Software	Computer Lab