UAB
Universitat Autònoma de Barcelona

Physical Foundations for Data Acquisition

Code: 104345
Credits: 9

2026/2027

Degree programme	Type	Course
Data Engineering	FB	1

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the end of the document.

Prerequisites

There are no academic prerequisites for this subject.

Objectives

This course is a general introduction to the most technological part of data acquisition. It is divided into two main parts:

- Hardware components involved in data acquisition processes
- Design principles of data acquisition systems

Therefore, the general objectives that are proposed for the subject are the following:

- Provide a clear and detailed understanding of the technological elements that are involved in the acquisition of data and their interconnection.

- Familiarize students with the concepts and methods of physics and electronics necessary for the resolution of problems that arise from the acquisition of structured data.

- Get students work with hardware components that allow obtaining data for subsequent processing.

- Provide students with the capacity of design of a data acquisition system related to the real world.

Learning outcomes

1. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
2. Search, select and manage information and knowledge responsibly.
3. Develop critical thinking and reasoning and know how to communicate it effectively in both your own language and in English.
4. Demonstrate sensitivity towards ethical, social and environmental topics.
5. Identify the different parts of a system (acquisition, processing and actuation).
6. Understand the functioning of the commonest sensors and that of the signal preprocessing (conditioning) that they require.
7. Identify the physical bases of the acquisition systems specific to medical images (X-rays, magnetism, radioactive isotopes).

Contents

Topic 1: Introduction to data acquisition

Topic 2: Architectures and systems for data acquisition

Topic 3: Data types

Topic 4: Physical foundations for data acquisition

Topic 5: Digital systems

Topic 6: Sensors

Topic 7: Conditioning of the signal

Topic 8: Data processing

Topic 9: Data acquisition applications

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Preparation of a synthesis essay	18	0.72	
Preparation and independent practices work	80	3.2	
Problem sessions	15	0.6	

Study and preparation for the evaluation tests	51	2.04
Lab sessions	18	0.72
Theory sessions	39	1.56

The teaching methodology is oriented to the learning of the subject in a continuous way. This process is based on the realization of four types of learning activities that will be developed throughout the course: theory sessions, problem sessions, lab sessions and synthesis essay.

Theory sessions, where the professor will expose the knowledge of the subject indicated in the syllabus, as well as indications to complete and deepen these contents. The active participation of the students will be encouraged, giving them the opportunity to ask about those concepts that are not clear enough or well understood. The teacher will ask questions or set problems to check the follow-up of the explained subject. Attendance at the synthesis essay sessions is mandatory, and attendance at the conference sessions will also be taken into account.

Problem sessions, where students must participate actively, individually and/or as a group, in solving problems to consolidate the scientific-technical knowledge presented in the theory sessions.

Lab sessions, where students' active learning will be promoted by working on the implementation of data acquisition systems, as well as developing critical reasoning skills and teamwork. The sessions will be prepared and documented by the teacher in advance and the students will have to prepare them before attending, reviewing the related theoretical knowledge and the technological aspects of the development.

Preparation of a synthesis essay, in which the students (in groups of three or four, supervised by the teacher) will design a data acquisition system. The essay should be presented in a written report and an oral presentation of the most important characteristics.

During the activities the student can not take photos or recordings without the teacher's consent.

The Virtual Campus, http://cv.uab.cat, is the platform used for communication with students.

CROSS-CURRICULA COMPETENCES

The cross-curricula competences assigned to thissubject are T02.00 - Search, select and manage information and knowledge responsibly and T03.00 - Develop critical thinking and reasoning and know how to communicate them effectively, both in their own languages and in English, these two competences will be worked on and evaluated in those activities where they work in groups, such as laboratory practices and in the preparation of the synthesis work; and T07.00 - Demonstrate sensitivity towards ethical, social and environmental issues. This competence is considered and evaluated in the report on the practice and in the synthesis work based on the questions formulated by the teacher.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Knowledge validation (or recovery) tests	45% - The minimum grade required for this part is 4 out of 10	4	0.16	1, 2, 5, 6, 7
Follow-up of lab sessions	35% - The minimum grade required for this part is	0	0	1, 2, 5, 6

	5 out of 10			
Evaluation of the synthesis essay	20%	0	0	1, 2, 3, 4

The single assessment system is not applicable in this subject.

1.- Evaluation criteria

The evaluation will be continuous and formative, based on the tests of validation of knowledge reached in the theory and problems part, in the laboratory practices and in the realization of a synthesis essay, where the students will accumulate the evidences of their learning. The constant, collaborative and quality work in the subject will be valued. The attainment of knowledge and skills will be valued based on the validation tests, the reports on the development of practices and the content of the work.

2.- Activities and instruments that will be used to evaluate

The evaluation will be carried out based on the work developed by the student in the activities proposed.

To assess, the following instruments are available: two validation tests will be carried out throughout the course of the theory and problems part. They are individual written tests that aim to validate if each student has acquired the knowledge and skills of the subject.

Practices will be assessed following the continuous evaluation method. They are compulsory and all reports must be summited. Practices marks will be based on the preparation of the practices, their execution and the final report. Practices can not be re-evaluated.

The synthesis essay is a compulsory activity, evaluated from a scientific paper and an oral presentation of it.

3.- Final qualification

The final grade of the subject will be calculated by weighting:

In 45% the qualification of the knowledge validation tests. Both tests will have the same weight with respect to the grade andto make average between them, a minimum of 4 out of 10 must beobtainedineach test. If any of the tests does not reach 4 out of 10, it may be retrieve on the final re-assessment date set by the School.

In 35% the qualification of the practical part, calculated from the weighted average of the qualifications of each of practive activity, provided that the adequate achievement has been demonstrated in the evaluation sessions. In order to pass this part, all the practice activities must be submitted and only one of them can have a grade lower than 4. The minimum grade required for this part is 5 out of 10.

In 20% the qualification of the synthesis essay. The minimum grade required for this part is 4 out of 10.

In order to pass the subject students need to get a final grade of the subject equal to or greater than 5, to have passed (grade equal to or greater than 5) practice activities and the synthesis work with a grade equal to or greater than 4.

Qualification review procedure

For each assessment activity, a location, date and time of review will be indicated in which the student will be able to review the activity with the teacher. In this context, it is possible to make claims about the grade of the activity, which will be evaluated by the teacher responsible for the subject.

If the student is not present to this review, he will not review this activity later.

4.- Re-assessment/Re-evaluation

Students whose is equal to or lower than 4 out of 10 in any of the partial tests of knowledge validation, can retrieve it at the end of the semester.

Practices cannot be re-evaluated.

Students whose synthesis essay mark is lower than 4 out of 10, may submit a second version of the essay if and only if they had handed in the essay by the delivery deadline.

5.- Fail

Fail willbe graded if the final grade = min {(4), weighted average of themarks of the subject}.

6.- Not Evaluable

A student who fails to take any validation test or practice session will be considered \"Not Evaluable.\"

7.- Dates of the validation tests

The dates of the validation tests are set at the beginning of the course and do not have an alternative re-sitting date if they are missed, except for the cases indicated in the UAB evaluation regulations. If there is any change in programming for reasons of adaptation to possible incidents, these changes will always be reported on the Virtual Campus.

8.- Concession of MH

Only students who have a grade equal to or higher than 9 points canobtain an MH.

As the number of MH can not exceed 5%of enrolled students, students whohave the highest final grades will be awarded.

9.- Irregularities

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committedby a student that may lead to a variation of the grade will be scored with a zero (0). For example, plagiarizing, copying or allowing, unauthorized use of AI (eg Copilot, ChatGPT or equivalent) etc. in any of the evaluation activities will imply failing it with a zero (0). The evaluation activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these evaluation activities to pass the subject, the student will fail this subject directly, without the opportunity to re-assess it in the same course.

In this course, the use of Artificial Intelligence (AI) technologies is permitted as an integral part of the development of the work, provided that the final result reflects a significant contribution from the student in terms of analysis and personal reflection. The student must clearly identify which parts have been generated using this technology, specify the toolsused, and include a critical reflection on how these tools have influenced the process and the final outcome of the activity. Lack of transparency in the use of AI will be considered academic dishonesty and may result in a penalty in the activity's grade, or more severe sanctions in serious cases.

10. Repeating Students

To receive differentiated treatment, the repeating student must send an email to the course coordinator atthe beginning of the course. Each case will be studied individually

Bibliography

- Emilio, M. D. P. (2013). *Data acquisition systems : from fundamentals to applied design*. Springer.

Data Acquisition Systems: From Fundamentals to Applied Design | SpringerLink

- Germán Corona Ramírez, L., Abarca Jiménez, G. S., & Mares Carreño, J. (2014). *Sensores y actuadores : aplicaciones con Arduino®* (Primera edición ebook). Grupo Editorial Patria.

https://fliphtml5.com/tmexm/iyua/Sensores_Y_Actuadores_Aplicaciones_Con_Arduino_Leonel_G._Corona/

- Fundamentos de los sensores: https://www.ni.com/es/shop/data-acquisition/sensor-fundamentals.html

Enlace web:

- Campus Virtual: https://cv.uab.cat

Software

There is no software requirement.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	81	Catalan/Spanish	first semester	morning-mixed
(PAUL) Classroom practices	811	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	811	Catalan/Spanish	first semester	morning-mixed
(PAUL) Classroom practices	812	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	812	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	813	Catalan/Spanish	first semester	morning-mixed