

**Physical Foundations for Data Acquisition**

Code: 104345  
ECTS Credits: 9

Degree	Type	Year	Semester
2503758 Data Engineering	FB	1	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

### Contact

Name: Marta Prim Sabria  
Email: Marta.Prim@uab.cat

### Use of Languages

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

### Teachers

Carles Ferrer Ramis  
Joan Oliver Malagelada  
Elena Valderrama Vallés  
Màrius Montón Macián

### Prerequisites

There are no academic prerequisites for this subject.

### Objectives and Contextualisation

This subject 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 vision of the technological elements that intervene 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 used to work with hardware elements that allow obtaining data for further processing.
- Provide students with the design capacity of a data acquisition system related to the real world.

## Competences

- Demonstrate sensitivity towards ethical, social and environmental topics.
- Develop critical thinking and reasoning and know how to communicate it effectively in both your own language and in English.
- Search, select and manage information and knowledge responsibly.
- 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.
- Use concepts and methods of physics and electronics necessary for solving problems deriving from the acquisition of structural data.

## Learning Outcomes

1. Demonstrate sensitivity towards ethical, social and environmental topics.
2. Develop critical thinking and reasoning and know how to communicate it effectively in both your own language and in English.
3. Identify the different parts of a system (acquisition, processing and actuation).
4. Identify the physical bases of the acquisition systems specific to medical images (X-rays, magnetism, radioactive isotopes).
5. Search, select and manage information and knowledge responsibly.
6. 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.
7. Understand the functioning of the commonest sensors and that of the signal preprocessing (conditioning) that they require.

## Content

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

## Methodology

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.

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.

## CROSS-CURRICULA COMPETENCES

The cross-curricula competences assigned to this subject 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.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lab sessions	18	0.72	5, 7, 2, 4, 3
Problem sessions	18	0.72	5, 7, 1, 2, 6
Theory sessions	39	1.56	5, 7, 1, 2, 4, 3, 6
Type: Supervised			
Preparation of a synthesis essay	15	0.6	5, 7, 1, 2, 3, 6
Type: Autonomous			
Preparation and independent practices work	96	3.84	5, 7, 4, 3, 6
Study and preparation for the evaluation tests	35	1.4	5, 7, 1, 2, 3, 6

## Assessment

### 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 submitted. 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 and to make average between them, a minimum of 3.5 out of 10 must be obtained in each test. If any of the tests does not reach 3.5 out of 10, it may be re-sit 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 practice 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 and to have passed (grade equal to or greater than 5) practice activities.

### 4.- Re-assessment/Re-evaluation

Students whose is equal to or lower than 3.5 out of 10 in any of the partial tests of knowledge validation, can re-sit them in a test 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 will be graded if the final grade =  $\min \{4.5, \text{weighted average of the marks of the subject}\}$ .

### 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. 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 can obtain an MH.

As the number of MH can not exceed 5% of enrolled students, students who have 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 committed by a student that may lead to a variation of the grade will be scored with a zero (0). For example, plagiarizing, copying or allowing an evaluation activity to be copied will imply failing this evaluation activity 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.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of the synthesis essay	20%	0	0	5, 1, 2, 6
Follow-up of lab sessions	35% - The minimum grade required for this part is 5 out of 10	0	0	5, 7, 2, 4, 3
Knowledge validation (or recovery) tests	45% - The minimum grade required for this part is 3.5 out of 10	4	0.16	7, 2, 4, 3, 6

## Bibliography

- Di Paolo Emilio, Maurizio, "Data Acquisition Systems From Fundamentals to Applied Design", Springer, 2013 <https://www.springer.com/gb/book/9781461442134>
- Leonel Germán Corona Ramírez, Griselda Stephany Abarca Jiménez, Jesús Mares Carreño, "Sensores y Actuadores. Aplicaciones con Arduino", Grupo Editorial Patria, 2014

Web link:

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