

| Degree programme               | Type | Course |
|--------------------------------|------|--------|
| Nanoscience and Nanotechnology | FB   | 2      |

## Contact lecturer

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## Prerequisites

## Group languages

You can consult this information at the [end](#) of the document.

There are none. The content and the methods introduced in this course presuppose knowledge of the first year *Fonaments de Matemàtiques* and *Càlcul*.

## Objectives

To provide the ability to use some tools of Applied Statistics and Probability necessary for the study of nanosystems: without presupposing any prior knowledge of Probability or Statistics the students must reach a degree of familiarity with various statistical techniques.

Students will learn to deal with problems related to data analysis, such as planning the research that will generate the data, analyzing the data obtained, and interpreting the results.

## Learning outcomes

- CM06 (Identify the mathematical nature of certain physical and chemical phenomena, in order to abstract the essential variables that describe them.) Identify the mathematical nature of certain physical and chemical phenomena, in order to abstract the essential variables that describe them.
- CM07 (Solve real-world problems that occur in the field of science and technology using mathematical tools and methods.) Solve real-world problems that occur in the field of science and technology using mathematical tools and methods.
- KM11 (Recognise the mathematical methods (calculus, algebra, numerical) used for probabilistic modelling.) Recognise the mathematical methods (calculus, algebra, numerical) used for probabilistic modelling.
- SM09 (Express oneself clearly using basic mathematical language.) Express oneself clearly using basic mathematical language.
- SM11 (Use statistical methods and programmes to process data and analyse specific problems.) Use statistical methods and programmes to process data and analyse specific problems.
- SM12 (Use graphical and numerical methods to explore, describe and interpret data.) Use graphical and numerical methods to explore, describe and interpret data.

## Contents

- Descriptive Statistics
- Introduction to Probability
- Random variables
- Sampling Distributions
- Point Estimation
- Confidence intervals
- Hypothesis Testing
- Linear regression

## Learning activities and methodology

| Title                                 | Hours | ECTS | Learning outcomes                  |
|---------------------------------------|-------|------|------------------------------------|
| Theory classes                        | 36    | 1.44 | CM06, CM07, KM11, SM09, SM11, SM12 |
| Personal study                        | 36    | 1.44 | CM06, KM11                         |
| Practical classes                     | 4     | 0.16 | CM07, SM09, SM11, SM12             |
| Exercises classes                     | 12    | 0.48 | CM06, CM07, KM11, SM09, SM11, SM12 |
| Problem solving                       | 52    | 2.08 | CM06, CM07, KM11, SM09, SM11, SM12 |
| Preparation of the practical sessions | 4     | 0.16 | KM11                               |

- Theory classes: The concepts and methods of the different subjects will be introduced, with a variety of examples.

- Problems classes: Teachers will solve selected exercises from a collection that will be available to the students beforehand.

- Practical classes: They will be held in a computer classroom. Activities will be proposed to be carried out by means of an adequate software. The results of this practical work must be presented within a given deadline.

- Autonomous work: It is imperative that students complement face-to-face activities with autonomous, individual or group work; to practice the resolution of problems is especially important.

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.

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## Assessment

### Continuous assessment activities

| Title                             | Weight | Hours | ECTS | Learning outcomes            |
|-----------------------------------|--------|-------|------|------------------------------|
| Partial exams                     | 80%    | 6     | 0.24 | CM06, CM07, KM11, SM09       |
| Results of the practical sessions | 10%    | 0     | 0    | CM07, KM11, SM09, SM11, SM12 |
| Delivery of solved problems       | 10%    | 0     | 0    | CM07, KM11, SM09, SM11, SM12 |

Partial exams: Two partial tests will be carried out, with a weight in the final evaluation of 40% each. At the end

of the course, a re-evaluation exam for this 80% will be held for students who need it.

Practical sessions and delivery of solved problems: The remaining 20% will come from the evaluation of the delivered problems and from the results of the practical sessions in equal parts. The presentation of the results of the practical sessions will be mandatory.

Re-evaluation: Only students who have completed 60% of the assessment activities may opt for the re-evaluation; this means both term tests, or one term tests, the practical sessions and all of the problems delivered.

The student who carries out evaluation activities that involve less than 50% of the total evaluation will be considered "not assessable".

#### Single Assessment:

Students following the single evaluation modality must take a final test similar to the partial exams but comprising all the subject matter. This test will be carried out on the same day that the second partial exam and it will account for a 90% of the grade.

The results of the practical sessions is also mandatory, in the same dates as the other students, and will account for the remaining 10% of the grade.

If necessary, students could take the same recovery exam as the rest of the students.

#### Use of AI:

In this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for bibliographic or information searches. For graded assignments, it is essential to clearly identify which parts were generated using this technology, specify the tools used, and include a critical reflection on how these tools influenced the process and the final result of the activity. Lack of transparency regarding the use of AI in these activities will be considered a breach of academic integrity and could result in a partial or full penalty on the assignment grade, or more severe sanctions in cases of serious misconduct.

## Bibliography

- R. Delgado de la Torre, *Probabilidad y estadística para ciencias e ingenierías*, Delta, 2008. [Available](#) in the library and [online](#).
- Ross, Sheldon M. (2009). *Introduction to probability and statistics for engineers and scientists*. (4th ed.) Elsevier Academic Press. [Available](#) online
- Gupta, Bhisham C. & Jayalath, Kalanka & Guttman, Irwin. (2020). *Statistics and probability with applications for engineers and scientists using Minitab, R and JMP*. (2nd ed.) Wiley. [Available](#) online
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## Software

RStudio

Python

#### 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      | 1     | Catalan  | second semester | afternoon |

|                               |   |         |                 |               |
|-------------------------------|---|---------|-----------------|---------------|
| (PAUL) Classroom practices    | 1 | Catalan | second semester | afternoon     |
| (PLAB) Practical laboratories | 1 | Catalan | second semester | morning-mixed |
| (PLAB) Practical laboratories | 2 | Catalan | second semester | morning-mixed |