

# **Probability and Statistics**

Code: 100965 ECTS Credits: 6

Degree	Туре	Year	Semester
2500253 Biotechnology	FB	2	1

# Contact

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### Teaching groups languages

You can check it through this <u>link</u>. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

# Prerequisites

A good achievement of the contents of the course of Mathematics of First of Biotechnology guarantees the knowledge that requires this subject, as well as basic notions of descriptive statistics that are used in laboratory practices or in the same practices of the integrated laboratory of this subject.

# **Objectives and Contextualisation**

Probability is the mathematical discipline that models random phenomena and is one of the theoretical bases on which Statistics is supported. Statistics is the basis for understanding the acquisition of empirical knowledge and underpins modern scientific thinking.

The aim of the subject is to introduce the fundamental tools of probability and statistical inference in order to analyze biological data from the description of natural phenomena or experiments, with an impact on their correct use and the interpretation of results, as well as competence training in order to develop scientific thinking and language.

Also learning a computer program with which to implement data analysis and carry out the tests studied in the course is essential and is carried out in a module of the Integrated Laboratories.

### Competences

- Make decisions.
- Reason in a critical manner

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• Use the fundamental principles of mathematics, physics and chemistry to understand, develop and evaluate a biotechnological process.

### Learning Outcomes

- 1. Analyse the relationship between variables using techniques for analysing variance, linear and non-linear regression, and correlation.
- 2. Correctly adjust experimental measurements for linear and non-linear regression.
- 3. Describe the basic properties of point estimators and interval estimators. Formulate and solve hypothesis contrast problems in one or two populations.
- 4. Explain the principles behind the theory of probability that underlie inferential statistics and recognise real situations in which the most common probabilistic distributions appear.
- 5. Make decisions.
- 6. Reason in a critical manner

### Content

0. Basic notions

Language of sets combinatorial

1. Probability and random variables

Notion of Probability. Conditional probability. Independent events Random variable. Hope and variance. Independent random variables Classical discrete distributions: Bernoulli, Binomial, Geometric, Poisson Classical continuous distributions: Uniform, Exponential, Normal and derived distributions

#### 2. Statistical inference in data analysis

Population and sample. Statistics: mean, variance and sample proportion Inference: point estimate and confidence intervals Hypothesis testing Parametric hypothesis testing Introduction to non-parametric hypothesis testing

3. The simple linear regression model

Estimation by the Ordinary Least Squares Method of the regression line Statistical inference to the coefficients

### Methodology

Theoretical classes:

The concepts of the subject will be presented. Examples will be presented that allow students to approach problem solving independently.

Problem classes:

Students will have a list of course problems (exhaustive enough, with extra exercises proposed for study), which they will work on progressively.

Independent activities:

Individual study of theory: reflection and deepening of the subject introduced through the class notes and the recommended bibliography.

Preparation of the problem classes: the students will try to solve the proposed problems, and limit the doubts that have arisen, which will have an impact on the use of the discussion on the board of the solution of the exercises in the problem class.

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.

### Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classes of problems	16	0.64	2, 1, 3, 4, 5, 6
Lectures	32	1.28	2, 1, 3, 4, 5, 6
Type: Autonomous			
Problem solving	64	2.56	2, 1, 3, 4, 5, 6
Study of the theory	32	1.28	2, 1, 3, 4, 5, 6

# Assessment

A continuous evaluation will be carried out by means of:

a) There will be an exam (First Partial = EP1) in the middle of the semester in which the work done until that moment will be evaluated. The mark of this exam will provide 40% of the final grade. All students who take this exam can no longer be graded as NON-EVALUABLE. A student who has not taken this exam will be listed as NON-EVALUABLE for academic purposes and will not have the right to retake it (except for a duly justified reason, in which case the retake exam will be allowed).

b) At the end of the semester there will be a second partial exam (called EP2) in which the knowledge of the subjects that have not been evaluated in the first partial will be evaluated. The mark of this exam will provide another 40% of the final grade. A student who has not taken this exam will not be entitled to retake it (except for a duly justified reason, in which case the resit exam will be allowed).

c) There will be an evaluation corresponding to the deliveries of exercises, with qualification ENT, that will be worth 20% of the final note. This part of the note will not be recoverable.

If the average C = (0.4) EP1 + (0.4) EP2 + (0.2) ENT is 5 or higher, the final grade is C. If not, the student must go to the exam recovery. Students who want to improve their mark can also take the entrance exam, but always keeping in mind that their final grade will be the mark of this exam, regardless of whether it is higher or not than C.

5% of the students will be able to obtain the qualification of Honorary Enrollment. They will necessarily have to have a grade equal to or higher than 9. The final decision on the MH grade will be made by the teacher.

For each evaluation activity, a place, date and time of review will be indicated in which the student will be able to review the activity with the teaching staff. In this context, claims may be made on the grade of the activity, which will be evaluated by the teacher responsible for thesubject. If the student does not appear for this review, this activity will not be reviewed later. Dates of problem deliveries and midterm exams will be posted on the Virtual Campus (CV) and may be subject to possible scheduling changes for reasons of adaptation to possible incidents; these changes will always be reported to the CV as the CV is understood to be the usual mechanism for exchanging information between teacher and students.

Students who take the single assessment must take an exam of the entire syllabus on the same day as the second partial exam. If they do not pass the exam, they have the right to present themselves for recovery as well as grade improvement.

### **Assessment Activities**

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery	20%	0	0	2, 1, 3, 4, 5, 6
Midterm exam II	40%	3	0.12	2, 1, 3, 4, 5, 6
Midterm examen I	40%	3	0.12	2, 1, 3, 4, 5, 6

# Bibliography

Sanz i Solé, Marta. 'Probabilitats', Col·lecció UB.

Delgado de la Torre, Rosario. 'Probabilidad y Estadística con aplicaciones'

### Software