

Degree programme	Type	Course
Genetics	FB	1

Contact lecturer

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Prerequisites

The same that give access to the degree

Group languages

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

Objectives

This course aims to convey mathematical knowledge that is essential for any science with a quantitative component, as it is the case with genetics. More specifically, it will focus, on the one hand, on the functions of one variable and the infinitesimal calculus, and on the other hand on the tools of probability and statistics. In both cases, the primary goal will be to understand the concepts and to argue correctly. Of course, it will also be about making these concepts operational, but always knowing what is being done and why. Finally, a third objective is to introduce some computer tools, especially in relation to the treatment of statistical data.

Learning outcomes

- CM14 (Integrate mathematical models and statistical tools into the quantitative analysis of genetic data to validate biological hypotheses.) Integrate mathematical models and statistical tools into the quantitative analysis of genetic data to validate biological hypotheses.
- KM08 (Define the fundamental concepts of calculation and descriptive statistics necessary for the treatment and analysis of data in genetics.) Define the fundamental concepts of calculation and descriptive statistics necessary for the treatment and analysis of data in genetics.
- KM09 (Identify graphic representation techniques and basic computational tools for the statistical analysis of genetic data.) Identify graphic representation techniques and basic computational tools for the statistical analysis of genetic data.
- SM11 (Apply mathematical calculation and basic inferential statistics for quantitative data analysis in biological contexts.) Apply mathematical calculation and basic inferential statistics for quantitative data analysis in biological contexts.
- SM12 (Analyse data sets using basic software and computing resources for graphing and statistics.) Analyse data sets using basic software and computing resources for graphing and statistics.

Contents

1. Concept of function. The most usual functions. Polynomial functions and rational functions. The exponential function. The logarithm function. Trigonometric functions.

2. Notion and calculation of derivatives. The derivative as growth rate.
3. Integration. Applications of the integral.
4. Differential equations. Exponential growth and decline. Logistic growth.
5. Descriptive statistics. Descriptive study of a variable: mean, standard deviation, bar diagrams. Descriptive study of two variables: contingency and regression tables.
6. Fundamentals of probability. Independence and conditional probability. Bayes theorem.
7. Random variables and more frequent distributions. Hope and variance.
8. Introduction to statistical inference. Confidence intervals and hypothesis contrasts.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Theory classes	31	1.24	CM14, KM08, SM11
Computer practises	5	0.2	KM09, SM12
Problems classes	11	0.44	CM14, KM08, SM11
Solving exercises	33	1.32	CM14, KM08, SM11
Personal study	59	2.36	CM14, KM08, KM09, SM11, SM12

The teaching methodology includes three main types of activities (theoretical classes, problem classes and practicals in the computer room) and one complementary one (tutorials).

Theory classes: provide the student with the basic conceptual elements and information so that they can then develop independent learning. In addition to the essential theoretical body, illustrative examples will also be presented and the main applications in Genetics will be discussed.

Problem classes: in these classes, which will be held in smaller groups, selected exercises will be solved where theoretical knowledge will be put into practice, while critical reasoning will be encouraged. In class, only a representative selection of the proposed exercises can be solved; the others will be left for the students' independent or group work outside of class times.

Practice in the computer room: They will provide an introduction to several common computer tools for mathematical and statistical computation.

Tutoring: Individual or small group tutoring is planned, in order to solve questions that remain doubtful, at a time to be arranged.

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
Submission of practical questionnaires	0.2	3	0.12	KM09, SM12
Second Block Partial Exam	0.4	2	0.08	CM14, KM08, SM11
First Block Recovery Exam	0.4	2	0.08	CM14, KM08, SM11
Second Block Recovery Exam	0.4	2	0.08	CM14, KM08, SM11
First Block Partial exam	0.4	2	0.08	CM14, KM08, SM11

The assessment is continuous and comprises two parts, which are specified below along with their weight in the final grade:

- Written exams (80%). They will consist of two partial exams in correspondence with the two parts into which the subject is divided (topics 1-4 and topics 5-8). Both exams will count equally, provided you have obtained a minimum grade of 4 out of 10 in each of them.
- Evaluation of practicals (20%): It will appraise the completion of computer practicals and the presentation of exercises related to them. The deliveries will take place at the end of the practical sessions. Each practical session contributes equally to the final practical grade. Unjustified absence from a practical session will be awarded a grade of 0 for that session. Exceptions will only be made in cases of illness or force majeure, subject to the submission of appropriate official documentation.

The final course grade is calculated as follows. Let NP denote the weighted grade, computed as 80% from the written exams (40% each) and 20% from the practical sessions. If a minimum grade of 4 out of 10 is obtained in both written exams, the final grade NF is equal to NP. Otherwise, the final grade NF is the lower of NP and 4. The course is passed if NF is greater than or equal to 5.

If NF is below 5, students may take the recovery exam for any partial exam they have failed, where applicable. The grade obtained in the recovery examination(s) will replace the corresponding partial exam grade(s). The final grade will then be recalculated using the same procedure described above. The practical sessions grade is not recoverable.

If the evaluation activities carried out do not gather a weight greater than 66.7%, then the student will receive the qualification of "Not assessed".

This course does not provide for the single assessment system.

Use of the AI: In this subject it is not allowed the use of Artificial Intelligence (IA) in any of his phases. Any work including fragments generated by IA will be considered a lack of academic honesty and can lead to a partial or total penalty in the activity grade, or bigger sanctions in case of gravity.

«Any irregularity committed during an assessment activity (including academic fraud, plagiarism, or the improper use of artificial intelligence, unless such use is explicitly authorized in the course syllabus) that may lead to a significant distortion of the assessment outcome will result in a grade of 0 for that assessment. If the course syllabus requires a minimum grade in that assessment activity in order to pass the course, or if multiple irregularities are committed in the assessment activities of the same course, the final course grade will be 0. In addition, students who engage in any of these irregularities may be subject to disciplinary proceedings.»

Bibliography

- Jaume Agudé, 2018. Matemàtiques i Modelització per a les Ciències Ambientals. (Autoedició)
- John Maynard Smith, 1968. Mathematical Ideas in Biology. Cambridge Univ Press.
- Xavier Bardina, Mercè Farré, 2005. Estadística : un curs introductori per a estudiants de ciències socials i humanes. (UAB, Col·lecció Materials)
- Rosario Delgado de la Torre, 2002. Apuntes de Probabilidad y Estadística (UAB, Col·lecció Materials)
- Newhauser, C. Matemáticas para Ciencias, Prentice Hall, Madrid
- Batschelet, E., Matemáticas básicas para biocientíficos, Dossat, Madrid
- Newby, J.C. Mathematics for the Biological Sciences, Clarendon Press

Software

The following software will be used: symbolic calculation software (Sage or WolframAlpha), grid calculation (Excel)

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	61	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	611	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	611	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	612	Catalan	first semester	morning-mixed
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