UAB
Universitat Autònoma de Barcelona

Mathematics

Code: 100967
Credits: 9

2026/2027

Degree programme	Type	Course
Biotechnology	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

The student should have acquired the contents of high school mathematics.

Objectives

This is the first of three courses in mathematics in the Biotechnology Degree. The aim is to provide a prior training on differential equations, which will continue in the course Numerical Methods and later on it will apply to the subjects of the Mention of Biotechnology Processes. Moreover, the foundations are laid for understanding the Probability and Statistics course. One of the objectives is to ease the required mathematical language for every scientist. One will stand out the interpretation of simple mathematical models of physical, chemical, ecology or genetic phenomena. The student must be able to interpret qualitatively the mathematical functions involved and the results which are derived from calculations.

Learning outcomes

- CM07 (Correctly adjust the data obtained in experimental results by linear and non-linear regression.) Correctly adjust the data obtained in experimental results by linear and non-linear regression.
- CM08 (Solve real problems in the field of biotechnology using mathematical tools and methods.) Solve real problems in the field of biotechnology using mathematical tools and methods.
- CM09 (Work collaboratively in teams to solve problems in the field of mathematics, with special emphasis on biotechnological applications.) Work collaboratively in teams to solve problems in the field of mathematics, with special emphasis on biotechnological applications.
- KM07 (Recognise simple mathematical models of physical, chemical or biological phenomena, whether discrete or continuous, described by a function or by a differential equation.) Recognise simple mathematical models of physical, chemical or biological phenomena, whether discrete or continuous, described by a function or by a differential equation.

- KM08 (Recognise the different types of mathematical errors, valuing their importance in the solution of mathematical problems.) Recognise the different types of mathematical errors, valuing their importance in the solution of mathematical problems.
- SM07 (Solve simple problems in the fields of algebra and calculus in one and several variables.) Solve simple problems in the fields of algebra and calculus in one and several variables.
- SM08 (Use statistical methods for data analysis and interpretation.) Use statistical methods for data analysis and interpretation.

Contents

-Basic notions of linear algebra.

- Systems of linear equations and matrices.

- Vectors in Rn: independence, bases, inner product.

- Eigenvectors and eigenvalues of a matrix.

- Matrix models.

-Calculus of one variable.

- Elementary functions.

- Derivatives.

- Maxima and minima. More models.

- Taylor's formula.

- Integration and calculation of primitives.

-Calculus inseveral variables and integration.

- Curves in the plane and in space.

- Graphic of a scalar function, curves and level surfaces.

- Partial derivatives, directional derivatives. Gradient and tangent plane.

- Higher order derivatives. Relative maxima and minima of functions of several variables.

- Constrained Extrema. Lagrange multiplier rule.

- Integration in one and several variables. Applications of integral: length of curves, calculation of areas and volumes, the center of mass.

-Differential equations.

- Approach and resolution of some type differential equations (linear, first and second order).

- Resolution and graphical representation.

- Examples of models with differential equations.

- Equiliubria and stability.

- Systems of differential equations.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Study of the theory	38	1.52	
Exercise resolution	80	3.2	
Individual practice with the computer	24	0.96	
Problem sessions	16	0.64	
Computer sessions	8	0.32	
Theory lectures	48	1.92	

Methodology Lectures: The main concepts of the course will be introduced. Although some of the material may constitute a review for certain students, it will be presented from a different perspective. Emphasis will be placed on the interpretation of the results and on the connection between these concepts and their applications. Examples will be provided to enable students to develop the skills needed to solve problems independently.

Problem sessions: The proposed exercises will be discussed in class. Problem sets will be distributed in advance and students are expected to work on them individually before the corresponding session.

Computer sessions: After an introduction to the computational tools used in each session, students will solve the exercises included in the laboratory guide. Numerical simulations will also be carried out to support the understanding of the theoretical concepts.

Authonomous activities: Individual study of the theory: Students are expected to reflect on and deepen their understanding of the material presented in class by using the lecture notes and the recommended bibliography. Preparation for the problems sessions: Students should attempt to solve the proposed exercises in advance in order to identify any questions or difficulties. This preparation will enhance the effectiveness of the in-class discussion of the solutions.

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
Theory and problems module	80%	9	0.36	CM07, CM08, CM09, KM07, KM08, SM07
Computer practice module	20%	2	0.08	CM07, CM08, CM09, KM07, KM08, SM07, SM08

-Theory and problems module (80% weight): The evaluation of this module will consist of three exams that will be carried out throughout the course. In case the overall mark of these exams is less than 5, the student will be allowed to participate in a global "second-chance exam". The maximum mark in the second-chance exam is 7 and replaces the marks obtained in the three exams.

-Computer practice module (20% weight): At the end of laboratory sessions 2 and 4, a short assessment will be administered to evaluate the tools and concepts covered in the previous laboratory sessions. The practical assessment grade is not recoverable.

-Students will receive the grade "Not Assessed" if the assessment activities completed account for less than 67% of the final course grade.

-Students who choose the single assessment option will take one comprehensive examination covering the theoretical contents, problem-solving exercises, and topics related to the laboratory sessions.

-This examination will be held on the same date as the third midterm examination, although its duration may be longer. The same resit policy as for continuous assessment will apply: students may take one comprehensive resit examination, with a maximum possible grade of 7.

-The use of Artificial Intelligence (AI) technologies is not permitted at any stage of this course. Any assignment containing content or passages generated by AI will be considered a breach of academic integrity and may result in a partial or total reduction of the grade for the assignment, or more severe disciplinary sanctions in serious cases. Any irregularity committed during an assessment activity-including academic fraud, plagiarism, or the improper use of artificial intelligence (AI), unless such use is explicitly authorized in the course syllabus-that may lead to a significant alteration of the assessment outcome will result in a grade of 0 for that assessment. If the course syllabus establishes that passing the course requires obtaining a minimum grade in that assessment, or if multiple irregularities are committed in different assessment activities within the same course, the final course grade will be 0. In addition, students found responsible for such irregularities may be subject to disciplinary proceedings in accordance with the University's academic regulations.

Bibliography

Bibliography:

- Camps, R., Matemàtiques, lecture notes.
- Solanes, G., Matemàtiques, lecture notes.
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- Carreras, F., Dalmau, M., Albeniz, F.J.M., Moreno, *J.M. Ecuaciones diferenciales*, UAB 1987.
- Grossman, S. I., *Algebra lineal*. Mc Graw Hill.
- Marsden, J.E., Tromba, A.J., *Càlculo vectorial*, Addison-Wesley, Iberoamericana, Wilmington Delawe, USA, 1991.
- Neuhauser, C., *Matemáticas para las Ciencias*, Prentice-Hall, 2004.
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- Salas, S. L., Hille E. i Etgen, G. J., *Calculus, volumen 1 i volumen 2*, Ed. Reverte, 2002.
- Zill, D.G., Ecuaciones diferenciales con aplicaciones de modelado, Cengage Learning, 9ed, 2009.

Software

SageMath with Jupyter Notebook

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	41	Catalan/Spanish	annual	afternoon
(PAUL) Classroom practices	411	Catalan/Spanish	annual	afternoon
(PLAB) Practical laboratories	411	Catalan/Spanish	annual	morning-mixed
(PAUL) Classroom practices	412	Catalan/Spanish	annual	afternoon
(PLAB) Practical laboratories	412	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	413	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	414	Catalan/Spanish	annual	morning-mixed