UAB
Universitat Autònoma de Barcelona

Mathematics

Code: 100967
ECTS Credits: 9

2024/2025

Degree	Type	Year
2500253 Biotechnology	FB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

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

Objectives and Contextualisation

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

1. CM07 (Competence) Correctly adjust the data obtained in experimental results by linear and non-linear regression.
2. CM08 (Competence) Solve real problems in the field of biotechnology using mathematical tools and methods.

3. CM09 (Competence) Work collaboratively in teams to solve problems in the field of mathematics, with special emphasis on biotechnological applications.
4. KM07 (Knowledge) Recognise simple mathematical models of physical, chemical or biological phenomena, whether discrete or continuous, described by a function or by a differential equation.
5. KM08 (Knowledge) Recognise the different types of mathematical errors, valuing their importance in the solution of mathematical problems.
6. SM07 (Skill) Solve simple problems in the fields of algebra and calculus in one and several variables.
7. SM08 (Skill) Use statistical methods for data analysis and interpretation.
8. SM08 (Skill) Use statistical methods for data analysis and interpretation.

Content

Basic notions of linear algebra.
- Systems of linear equations and matrices: staggering, matrix operations, inverse, determinant and rank.
Geometry of plane and space.
- Vectors in Rn: independence, bases, inner product.
- Eigenvectors and eigenvalues of a matrix. Some matrix models.

Calculus of one variable.
- Derivative. Elementary functions.
- The mean value theorem and its consequences. Maxima and minima.
- 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).
- Computer resolution and graphical representation.
- Examples of models with differential equations.
- Systems of differential equations.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Computer sessions	8	0.32	CM07, SM07, SM08
Problem sessions	16	0.64	CM07, CM08, CM09, SM07
Theory lectures	48	1.92	CM08, KM07, KM08, SM07
Type: Autonomous			

Exercise resolution	80	3.2	CM07, CM08, CM09, SM07, SM08
Individual practice with the computer	24	0.96	CM07, CM08, SM07, SM08
Study of the theory	37	1.48	CM07, CM08, KM07, KM08, SM07, SM08

Theory lectures:

The main concepts of the course will be presented in those lectures. Part of these topics will be known to some students, although the viewpoint will be new. Special emphasis will be put in the interpretation of the results and on their relation with applications. Examples will be presented allowing the students to solve problems on their own.

Problem sessions:

The resolution of some proposed exercises will be discussed. These exercises will be given in advance to the students, who will work on them individually.

Computer sessions:

In these sessions, students will use mathematical software to solve the proposed exercises. There will also be some simulations to illistrate the notions introduced in the theory lectures.

Authonomous activities:

Individual study: reflexion and deepening on the contents based on lecture notes and bibliography.

Preparation of the problems sessions: the students will try to solve the proposed exercises, and will expose their difficulties in the problems sessions.

The students will also incorporate to their individual study the software tools seen in the computer sessions.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Computer practice module	10%	2	0.08	CM07, CM08, CM09, SM07, SM08
Exercise delivery module	10%	1	0.04	CM07, CM08, CM09, SM07, SM08
Theory and problems module	80%	9	0.36	CM08, KM07, KM08, SM07

1. Theory and problems module (80% weight):

The evaluation of this module will consist of three exams that will be ca
In case the overall mark of these exams is less than 5, the student will

The maximum mark in the second-chance exam is 7 and replaces the marks obtained in the three exams.

2. Computer practice module (10%

weight

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There will be an individual exam with computers. Students will have to

calculations and represent the graphs.

3. Exercise delivery module (

10%

weight)

Throughout the course, there will be several evaluation activities using

few problems that the student will have to solve and deliver virtually.

The students will obtain the "Non-assessable" qualification when the evaluation activities carried out have a weig

less than 67% in the final grade

Unique assessment:

The student who opts for the unique assessment of the subject will take a
This exam will be held to coincide with the date of the third partial exam o

Bibliography

Bibliography:

- Camps, R., Matemàtiques, lecture notes.
- Solanes, G., Matemàtiques, lecture notes.
- Braun, *Ecuaciones diferenciales y sus aplicaciones*, Grupo Editorial Iberoamericana, 1990.
- 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.
- Pita, C., *Cálculo Vectorial*, Prentice-Hall, 1995.
- 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

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	411	Catalan	annual	afternoon
(PAUL) Classroom practices	412	Catalan	annual	afternoon
(PLAB) Practical laboratories	411	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	412	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	413	Catalan	annual	morning-mixed
(PLAB) Practical laboratories	414	Catalan	annual	morning-mixed
(TE) Theory	41	Catalan	annual	afternoon