UAB
Universitat Autònoma de Barcelona

2019/2020

Mathematics

Code: 100967
ECTS Credits: 9

Degree	Type	Year	Semester
2500253 Biotechnology	FB	1	A

Contact

Name: Gil Solanes Farrés

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Use of Languages

Principal working language: catalan (cat)

Some groups entirely in English: No

Some groups entirely in Catalan: Yes

Some groups entirely in Spanish: No

Teachers

Enric Nart Viñals

Francesc Perera Domènech

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.

Competences

- Reason in a critical manner
- Use ICT for communication, information searching, data processing and calculations.
- Use the fundamental principles of mathematics, physics and chemistry to understand, develop and evaluate a biotechnological process.

Learning Outcomes

1. Correctly use mathematical language, and perform simple calculations by hand or using symbolic calculus programmes.

2. Formulate and solve certain types of differential equations, using analytical or numerical methods.
3. Formulate simple mathematical models of physical, chemical or biological phenomena, both discrete and continuous, and described by a function or a differential equation, and use the basic tools of linear algebra and calculus to obtain information.
4. Interpret the graphs of functions of one or more variables and relate them to their formulae.
5. Reason in a critical manner
6. Use ICT for communication, information searching, data processing and calculations.

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: radioactive materials, blood glucose levels, epidemic growth models, population growth.
- Systems of differential equations.

Methodology

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 on the blackboard. 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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Computer sessions	8	0.32	6, 4, 5, 1
Problem sessions	16	0.64	3, 4, 2, 5, 1
Theory lectures	48	1.92	3, 4, 2, 5, 1
Type: Autonomous			
Exercise resolution	80	3.2	3, 2, 5, 1
Individual practice with the computer	24	0.96	6, 4, 5, 1
Study of the theory	37	1.48	3, 4, 1

Assessment

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

To participate in the second-chance exam, the students must have previously been assessed in a set of activities

2. Computer practice module (10%

weight

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

3. Exercise delivery module (

10%

weight)

Throughout the course, there will be several evaluation activities using

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

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Computer practice module	10%	2	0.08	6, 4, 1
Exercise delivery module	10%	1	0.04	3, 2, 1
Theory and problems module	80%	9	0.36	3, 4, 2, 5, 1

Bibliography

Bibliography:

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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.
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- Salas, S. L., Hille E. i Etgen, G. J., *Calculus, volumen 1 i volumen 2*, Ed. Reverte, 2002.
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