COURSE DATA

Data Subject	
Code	36829
Name	Matemáticas
Cycle	Grade
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
1106 - Degree in Biology	Faculty of Biological Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
1106 - Degree in Biology	1 - Matemáticas	Basic Training

Coordination

Name	Department
CORBERAN VALLET, ANA	130 - Statistics and Operational Research
GARCIA MONERA, MARIA	363 - Mathematics
PEÑAFORT SANCHIS, GUILLERMO	363 - Mathematics

SUMMARY

The module **Mathematics** is part of the scientific background to be acquired by every student of Biology before fully entering into the core of the degree.
This module tries to fill the gaps in mathematical knowledge that many students who enter university have.
Thus, the module begins with an introduction where we review some issues as operations with numbers and vectors, elementary functions, graphs of functions and their interpretation, and so on.
Also the module gives the basic math and probability skills for any experimental science as:
a) Differential and integral calculus necessary to understand the math involved in issues related to speed, slope, determining maximum and minimum, measuring areas, etc.
b) An introduction to differential equations, with more emphasis in the concept and meaning of its solutions than in the resolution methods.

c) An introduction to the mathematical methods used in some specific areas of biology.

d) An introduction to the basic concepts of probability and some simple probability models.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is required, that the student has the skill in math calculation at the level of first-year mathematics at high school.
It is recommended, that the student has the knowledge of second year mathematics at high school.
It is advisable to know the basic concepts of Probability corresponding to Mathematics I in the first year of high school.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1106 - Degree in Biology

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Interpret, analyse, evaluate, process and synthesise biological data and information by applying mathematical and statistical methods.
- Organise, plan and manage information in a manner that allows the individual to analyse, synthesise and develop critical reasoning that can be applied to solve problems, make decisions and carry out work.
- Use scientific language, both oral and written, and be able to adapt the register to the target audience and/or readers. Use the most common foreign languages in each discipline as a vehicle for communication in a globalised system.
- Use ICTs, apps and other computer tools to manage and disseminate information in both educational and professional environments.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

- Know how to interpret graphs of functions in different representation systems, as well as know how to change from one type of graphic representation to another.

- Present biological problems that use linear equations and solve them using mathematical calculation software.

- Properly use of the derivative and integral concepts of functions that describe biological processes.

- Plan simple experiments useful to achieve the objectives of the study.

- Describe and adequately synthesize the set of data observed in the experiment.

- Analyze the observed data by using the appropriate software.

- Correctly interpret the results provided by the software used.

- Prepare and present a report on the study carried out.

DESCRIPTION OF CONTENTS

1. The derivative

1. The derivative of a function of one variable as a speed. Computation of derivatives.
2. The derivative of a function as the gradient of its graph.

2. Numerical resolution of equations

Numerical methods for solving equations based on the use of the derivative: Bolzano's Theorem and Intermediate Value Theorem; The bisection method; Newton's method.

3. Optimization

1. Critical points for functions of one variable.
2. Absolute maximums and minimums.
3. Relative maximums and minimums.
4. Concavity and convexity.
5. Drawing and interpreting graphs.

4. The integral of functions of one variable

1. Primitives or antiderivatives.
2. Some integration methods.

5. Definite integral

1. Definite integral definition. relation to the primitive.
2. Barrow's rule.
3. Applications of the integral calculus to the calculation of areas.

6. Notions of numerical integration

1. Formula of rectangles.
2. Formula of the trapezoids.

7. Resolution of differential equations of the form y' = f(t)

1. First order ordinary differential equations: General concepts. Constant dependency. Initial conditions.
2. Differential equations of the form y' = f(t).

8. Differential equations of separable variables y' = f(t)g(y)

Solution method. Examples

9. Applications of differential equations to biology

1. Population dynamics: Malthus or exponential model.
2. Newton's law of cooling.
3. Dynamics of growth of an individual : Bertalanffy model.
4. Problems of mixing.

10. Introduction to the calculation of probabilities. Remarkable probability distributions.

1. Events and probability. Conditional probability.
2. Random variable. Types of variables.
3. Discrete and continuous probability distributions.
4. Simulation of random variables.
5. Central Limit Theorem.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	31,00	100
Computer classroom practice	26,00	100
Tutorials	3,00	100
Development of individual work	9,00	0
Study and independent work	21,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	25,00	0
Preparation of practical classes and problem	20,00	0
Resolution of online questionnaires	5,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

In the theoretical part of this module (non-compulsory), the lecturer will introduce gradually the contents of this module using as much examples and specific problems (biological in nature as far as possible) as possible. In addition, he will propose to students some activities that require understanding of concepts and techniques learned in lectures.

Also the practical part of this module (compulsory) is dedicated to problem solving in groups. This sessions are held in computer labs, introducing the students to mathematical software illustrating the new concepts learnt in lectures. Each group will provide one answer to the exercises proposed to be qualified by the teacher.

Finally, there will be compulsory some hours lecture with the tutor.

EVALUATION

The activities of this module are grouped into the following **blocks of evaluation:**

BLOCK 1.- An examination paper consisting mainly of practical exercises. The mark got in this exam will count 70% of final grade.
BLOCK 2.- Practical activities done along the term by students. The mark obtained will count 20% of final grade.
BLOCK 3.- Evaluation of homework, memory and/or oral presentation carried out. The mark obtained

will count 10% of final grade.

Each BLOCK will be marked independently and the student will fail if the mark in any of the BLOCKS is less than 4/10.

A student can resit the examination paper of BLOCK 1. The mark got in BLOCK 2 will be maintained in one academic year while the mark got in BLOCK 3 will be maintained in two academic years.

REFERENCES

Basic

- C. Neuhauser "Matemáticas para Ciencias", Prentice-Hall, Madrid, 2004.
  J. Stewart "Cálculo: conceptos y contextos", 3ª edición, Internacional Thomson, México, 2006.
  R. L. Larson & B.H. Edwards "Cálculo 1", McGraw Hill 2010.
  D.Z. Zill & W. Wright "Cálculo de una variable", McGraw Hill 2011.
  M.L. Samuels, J.A. Witmer & A. Schaffner Fundamentos de Estadística para las Ciencias de la Vida, 4ª edición, Pearson, Madrid, 2012.

Additional

- S. T. Tan "Applied Calculus for the Managerial, Life, and Social Sciences", 5th Edition, Thomson Learning, Belmont 2002.