

Mathematics

Code: 100814
ECTS Credits: 6

| Degree | Type | Year | Semester |
|-------------------------------|------|------|----------|
| 2500251 Environmental Biology | FB | 1 | 1 |

Contact

Name: Enric Nart Viñals
Email: Enric.Nart@uab.cat

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

Silvia Cuadrado Gavilán

Prerequisites

The prerequisites of this subject are those given at the preparatory course in mathematics offered by the Facultat de Biociències.

Objectives and Contextualisation

For a university degree in Biologia Ambiental it is important to achieve a solid mathematical formation. In this sense, this subject has a double aim. On one hand, to give the student the necessary mathematical background in the fields of linear algebra and differential calculus, allowing him/her, and this is the second aim, to build up mathematical models for some biological problems.

Competences

- Design models of biological processes.
- Display basic knowledge of mathematics, physics and chemistry.
- Focus on quality.
- Reason critically.
- Solve problems.

Learning Outcomes

1. Focus on quality.
2. Handle exponential, logarithmic and potential functions with ease, and apply these to solving problems in biology: acceleration of metabolism with the temperature, decomposition of organic matter, allometries.
3. Handle vectors and matrices with ease, and appreciate how these can simplify problem-solving in biology: projection of the size of a population, quantitative genetics and ordering methods in multivariable analysis.

4. Reason critically.
5. Solve problems.
6. Use rudimentary calculus by formulating and solving models of interest in biology: model of exponential growth of populations.

Content

Part I. Fundamental mathematics

1. Real numbers and functions in one variable
2. Limits and derivation of functions
 - 2.1 Limits and continuity.
 - 2.2 Derivative. Geometric and kinematical interpretations. Chain rule.
3. Graphical representation of functions
 - 3.1 Domain of definition and asymptotes.
 - 3.2 Increase. Convexity. Maximal and minimal values.
4. Integration of functions
 - 4.1 Primitives. Integral. Fundamental Theorem of Calculus.
 - 4.2 Computation of areas and volumes.

Part II. Biomathematics.

5. Population dynamics
 - 5.1 Matrices, proper vectors and proper values. Diagonalization.
 - 5.2 Linear population growth. Ecosystems with species in competence.
6. Differential equations
 - 6.1 Separation of variables. Exponential growth, radioactive disintegration, logistic equation.
 - 6.2 Linear equations. Examples.

Methodology

Oral expositions will be devoted to transmit the different topics and scientific knowledge of the subject to the student.

Problem sessions are fundamental for the student to achieve a deep understanding of these contents. These classes are organized around a list of problems that the students try to solve.

This is complemented with individual tutorial assistance to clarify some doubts, or to discuss the results of the different evaluation activities.

The student will have to solve some special exercises, which contribute with a 15% to the final marks.

Activities

| Title | Hours | ECTS | Learning Outcomes |
|---------------------|-------|------|-------------------|
| Type: Directed | | | |
| oral expositions | 26 | 1.04 | 1, 6, 4, 5 |
| practical classes | 25 | 1 | 1, 6, 4, 5 |
| Type: Supervised | | | |
| tutorial assistance | 6 | 0.24 | 1, 6, 4, 5 |
| Type: Autonomous | | | |
| Problem solving | 30 | 1.2 | 1, 6, 4, 5 |
| Special exercises | 15 | 0.6 | 1, 6, 4, 5 |
| Studying | 34 | 1.36 | 1, 6, 4, 5 |

Assessment

The partial exam will be taken by the half of the term and it will include the topics explained up to then. The global exam will include the whole content of the subject.

Besides these two exams there will be a recovery exam for those students who did not pass the subject. This recovery exam will weight 85% of the final mark. The resting 15% will continue to be the submission of exercises mark, which admits no reevaluation.

The student who did not pass the course and does not take the recovery exam will receive a qualification of "No Avaluable".

Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|----------------------------|-----------|-------|------|-------------------|
| 1. Partial exam | 35% | 4 | 0.16 | 1, 2, 3, 6, 4, 5 |
| 2. Global exam | 50% | 6 | 0.24 | 1, 2, 3, 6, 4, 5 |
| 3. Submission of exercises | 15% | 4 | 0.16 | 1, 2, 3, 6, 4, 5 |

Bibliography

There is no text book fitting exactly the content of the subject. The following text books cover different parts of the course.

- Matemáticas para ciencias de C. Neuhauser (Pearson, Prentice Hall)
- Matemáticas básicas para biocientíficos de E. Batschelet (Editorial Dossat)
- Apunts d'àlgebra Lineal de E. Nart i X. Xarles, Materials de la UAB, 237
- Calculus, Tomo I de S. Salas i E. Hille (Editorial Reverté)
- Mathematics for the Biological Sciences de J.C. Newby (Clarendon Press).

- Mathematical ideas in Biology de J. Maynard Smith (Cambridge U.P.)