Universitat Autònoma de Barcelona

2023/2024

Biosphere Sciences

Code: 100769
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OB	3	2

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Josep Piñol Pascual

Víctor Flo Sierra

Javier De la Casa Sánchez

Prerequisites

There are no prerequisites, but it is recommended to have passed Ecology, Mathematics and Physics.

Objectives and Contextualisation

The objective is to know and analyze the processes that determine the functioning of the biosphere on a global scale, with a particular emphasis on the mutual interaction between biota and geophysical components, and on the alterations that human activity is introducing. It will also be considered the environmental history of the Earth as a tool to understand the processes that currently govern the functioning of the planet.

This implies a conception of the Earth as a system with different components interconnected in the atmospheric, oceanic and continental environments. This connection results on processes as balance and flow of energy, climate system, atmospheric and ocean circulation, primary production, distribution and functionalism of biomes, nutrient fluxes.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply statistical and computer resources to the interpretation of data.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Characterise, manage, conserve and restore populations, communities and ecosystems.
- Develop a sensibility towards environmental issues.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Understand the processes that determine the functioning of living beings in each of their levels of organisation.
- Work in teams.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Analyse a situation and identify its points for improvement.
3. Apply statistical and computer resources to the interpretation of data.
4. Be able to analyse and synthesise.
5. Be able to manage, conserve and restore all kinds of populations, communities and ecosystems.
6. Be able to organise and plan.
7. Critically analyse the principles, values and procedures that govern the exercise of the profession.
8. Develop a sensibility towards environmental issues.
9. Identify the different levels of biological organisation and understand how these are all integrated on a global scale.
10. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
11. Propose new methods or well-founded alternative solutions.
12. Propose viable projects and actions to boost social, economic and environmental benefits.
13. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
14. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
15. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
16. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
17. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
18. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.

19. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
20. Work in teams.

Content

PART 1

1. Introduction. Why about biosphere sciences? The Earth system and its components. Global change.

2. Introduction to systems theory. Positive and negative feedback. Equilibrium states and tipping points. Qualitative behavior of dynamic systems.

3. The global balance of energy.Electromagnetic energy. Albedo. Equilibrium temperature of a planet. Composition of the atmosphere and the greenhouse effect. Main climatic feedbacks.

4. Atmospheric circulation system. Vertical and horizontal movement of the air. Atmospheric circulation at different latitudes. The effect of Coriolis and the distribution of surface winds. Global distribution of temperature and precipitation. The global hydrological cycle.

5. Ocean circulation. Winds and superficial currents. Convergence, divergence and upwelling. El Niño. Teleconnexions. Salinity and thermohaline circulation. Deep circulation of the oceans. Effect of ocean circulation on climate.

6. Cryosphere. Components of the cryosphere. Snow cover. Permafrost. Glaciers, Greenland and Antarctica. Marine ice. Interactions between the atmosphere and the cryosphere.

7. Lithosphere. Inner Earth structure. Plate tectonics and continental drift. The recycling of the lithosphere: vulcanism, orogeny, weathering, sedimentation.

PART 2

8- Environmental history of the Earth system. Techniques of environmental reconstruction of the past. History of climate, atmospheric composition and continents. Evolution of the biological groups along the Earth history.

9- Distribution of primary production. Measurement of primary production. Limiting factors in terrestrial and aquatic ecosystems. Changes induced by human activity.

10- Terrestrial biomes functioning. Tropical rainforest, tropical deciduous forests, savannahs, warm deserts, Mediterranean forests and shrublands, cold deserts, deciduous forests, temperate rainforests, prairies, boreal forests, tundra.

11- Effect of biota on the atmosphere and the climate. Climate-vegetation feed-backs at global and regional scales: albedo, evapotranspiration, chemical composition of the atmosphere. Control of the concentration of atmospheric gases: oxygen, N_2O, CO_2, methane, DMS.

12- Carbon balance. The cycles of organic and inorganic carbon in the short and long term. Sources and sinks. Anthropogenic modifications of the carbon cycle.

13- Global nutrient cycles. Global cycle of N in terrestrial and marine ecosystems: atmospheric flows, recycling and anthropogenic modifications. Global cycle of P: sedimentation and long-term return. S global cycle: atmospheric fluxes and anthropogenic modifications.

14- Global change and climate change. History and causes of global change. Recent climate change. Global circulation patterns and scenarios of global change. Changes in atmospheric chemistry: ozone layer - origin, effects and anthropogenic alteration. Impacts of global change in biota and human systems. Land use changes. Strategies for mitigation and adaptation. Geoengineering.

Methodology

Theory classes: they provide the main knowledge of the proposed subjects. However, personal study and information search is essential for the acquisition of this knowledge.

Classroom practicum: they will be based on presentations by students of topics proposed by the teachers; the presentations will be prepared in group. The contents, and the rigorous communication in public will be valued. Assistance and participation in the seminars presented by other students will also be valued, carrying out questionnaires in the classroom about the presentations.

Problem classes: Numerical resolution of problems related to the contents of some topics. They may involve the complete resolution of problems in the classroom or the correction of problems previously proposed to students. They will also be done in computer classrooms.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom seminars	16	0.64	3, 5, 9, 8, 4, 6, 20
Problem computer classes	4	0.16	3, 4, 6
Theory classes	30	1.2	3, 9, 8, 4
Type: Supervised			
Tutorial	5	0.2	
Type: Autonomous			
Problemes report	10	0.4	3, 9, 4, 6
Seminars preparation	20	0.8	5, 9, 8, 4, 6, 20
Study	58	2.32	9, 4

Assessment

The evaluation will be based on different activities: exams, oral presentations in public by the student, problems and resolution of questionnaires in class or autonomously. The program is structured in two parts that comprise approximately half of the content each one.

There will be two exams corresponding to the two parts of the programt. To pass the program, a minimum score of 4.5 must be obtained in both exams. Students with a mark of less than 5 in any of the exams may do another examination at the end of the course. The student can only do these additional exam from the non-approved previous exams of each part (with a score of less than 5); it is not contemplated that the additional exams serve to raise the score of the approved exams.

The final grade will be obtained by weighting the scores of the different activities in the following proportion:

- Exam of the first part of the program: 30%.

- Exam of the second part of the program: 30%.

- Problems and computer practicum: 20%.

- Seminars (oral presentation and questionnaires): 20%.

To pass the course, the final grade must be equal to or equal to 5.

The recovery system contemplates a written additional exam corresponding to the examinations of the first and the second part.

The students will obtain a "Non-Valuable" qualification when the evaluation activities carried out have a weighting of less than 67% in the final grade.

The single evaluation consists of a single exam in which the contents of the entire theory program will be assessed. The exam will consist of short questions on topics to be developed and the grade obtained in this exam will account for 60% of the final grade. The evaluation of computer practice activities and seminars will follow the same process as the continuous evaluation and the grade obtained will represent 40% of the final grade of the subject. The delivery of evidence from the computer practices and seminars will followthe same procedure as the continuous evaluation. Students who take the single evaluation can hand in all the evidence together on the same day as the one set for the theory exam.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Computer practicum	10%	1	0.04	3, 8, 4, 20
Exams	70%	4	0.16	18, 3, 5, 9, 17, 16, 15, 4
Seminars	20%	2	0.08	1, 19, 18, 7, 2, 9, 10, 11, 12, 15, 13, 14, 8, 4, 6, 20

Bibliography

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Software

Excel