Universitat Autònoma de Barcelona

2021/2022

Biosphere Sciences

Code: 100820
ECTS Credits: 6

Degree	Type	Year	Semester
2500251 Environmental Biology	OB	3	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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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

Josep Piñol Pascual
Enrique Doblas Miranda
Xènia Rodríguez Miret

Prerequisites

Those of the degree.

Objectives and Contextualisation

The main objective is to know and analyze the processes that determine the functioning at a global scale of the biosphere, with a particular emphasis on the mutual interaction between the biota and the geophysical components, and on the alterations that human activity is producing in this functioning. It will also deal with 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 interconnected compartments (atmosphere, oceans and continental environments) through the energy balance and flow, the climate system, the atmospheric and ocean circulation, the primary production, the distribution and functionalism of the biomes, and the fluxes of the main chemical elements and compounds.

Competences

- Describe, analyse and assess the natural environment.
- Design models of biological processes.
- Develop a sensibility towards environmental issues.
- Develop analysis and synthesis skills.
- Develop strategies of analysis, synthesis and communication in order to teach biology and environmental studies.

- Focus on quality.
- Know a foreign language (English).
- Reason critically.
- Understand the bases of regulation of vital functions of organisms through internal and external factors, and identify environmental adaptation mechanisms.
- Work in an international context.

Learning Outcomes

1. Develop a sensibility towards environmental issues.
2. Develop analysis and synthesis skills.
3. Focus on quality.
4. Identify the principal effects of climate change on different planetary systems, especially on the biota.
5. Interpret the principal models for predicting climate change.
6. Know a foreign language (English).
7. Reason critically.
8. Recognise the different factors that determine the distribution of biological diversity on the scale of the whole biosphere.
9. Recognise the processes that determine energy and matter balances on a planetary scale.
10. Work in an international context.

Content

Part I

1- Introduction.

Why Biosphere Sciences? The Earth System and its components. Global change.

2. Introduction to a systems theory

Positive and negative feed-backs. Dynamic equilibrium and tipping points. Qualitative behaviour of dynamic systems.

3- Global balance of energy

Planetary energy balance. Atmospheric composition and greenhouse effect. Climatic feed-backs. Energy transport across the Earth.

4- Atmospheric circulation

Cells of atmospheric circulation. Wind regime. Global distribution of temperatures and precipitation: climatic regions.

5- Hydrosphere

Light gradients, temperature and salinity in oceans. Ocean surface circulation. Ocean deep circulation. El Niño, La Niña and ENSO. Climate teleconnections.

6- Criosphere

Components of the criosphere. Snow cover Permafrost. Glaciers and ice platforms: Greenland and Antartida. Sea ice. Interactions between atmosphere and criosphere.

7- Lithosphere

Internal Earth structure of. History of the Earth. Plate tectonics and continental drift. Weathering and sedimentation. Volcano activity.

Part II

8- Environmental history of the Earth.

Techniques of environmental reconstruction of the past. History of climate, atmospheric composition and continents. Evolution of the biological diversity along the Earth history.

7- Distribution of primary production

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

8- 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.

9- Effect of biota on the atmosphere and 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, N2O, CO2, methane, DMS.

10- Carbon balance

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

11- 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.

12- 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.

Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

Theory class: The fundamental contents of the subject will be explained, emphasizing those of more difficult comprehension for the student. The basic material of the presentations made by the teacher will be provided. These classes are complementary to the student's activity based on reading and studying textbooks.

Classroom practicum: they will be based on students presentations on subjects proposed by the teachers. They will be prepared in group. The contents, and the rigorous communication capabilities in public will be valued. The attendance at the seminars presented by other students will also be valued, carrying out questionnaires on the classroom presentations.

Problems practicum in classroom: 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.

Problems practicum in computer room: numerical resolution of problems related to the contents of some subjects.

Practical exercises: a series of exercises will be proposed, which can be numerical, reasoning, graphic repensation, etc., to be solved individually or in a group. The student will be provided with the basic instructions and information necessary for their resolution, stimulating and valuing the student's creativity and ability to research at the same time. The exercises must be delivered promptly within the established deadlines and must be edited properly.

Fieldtrip: exit to an installation with educational resources (museum) following the guidelines set by the teachers, which will indicate the activities to be carried out, as well as the works that must be presented.

Tutorials: The tutorials will be carried out at scheduled hours in the teacher' office. If the development of the subject, and particularly the exercises, requires it, a part of the tutorials can be done in the classroom in hours and location to be specified.

Theproposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

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	7	0.28	6, 8, 1, 10
External visit	4	0.16	2, 4, 5, 1
Problems in computer room	3	0.12	5, 7, 9
Problems seminars	4	0.16	3, 5, 7, 9
Theory classes	32	1.28	2, 4, 5, 7, 8, 9, 1
Type: Supervised			
Practical exercises	10	0.4	2, 3, 4, 5, 7, 8, 9
Tutorial	5	0.2	6, 2, 3, 4, 5, 7, 8, 9, 1, 10
Type: Autonomous			
Reports	24	0.96	2, 3, 4, 5, 7, 8, 9, 10
Study	40	1.6	6, 2, 3, 4, 5, 7, 8, 9, 1, 10
Text reading	15	0.6	6, 2, 3, 4, 5, 7, 8, 9, 1, 10

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 score 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%.

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

- Practical work of the first part of the program (questionnaires and problems): 20%.

- Practical work of the second part of the program (oral presentation and questionnaires): 20%.

The recovery system contemplates a written additional exam corresponding to the examinations of the first and the second part, as well as a set of sequential written tests on the practices of the second part.

To participate in the recovery, the students must have been previously evaluated in a series of activities with a weight equivalent to a minimum of two thirds of the total grade of the program.

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.

Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	60%	6	0.24	2, 3, 4, 5, 7, 8, 9
Reports	40%	0	0	6, 2, 3, 4, 5, 7, 8, 9, 1, 10

Bibliography

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Software

Simulation programs from the book *Ecología con Números.* Available a http://ddd.uab.cat/record/225887