



(*)Facultade de Bioloxía

Presentación

<http://bioloxia.uvigo.es/en/faculty/presentation>

Dean Team

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Grado en Biología

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V02G031V01101	Biology: Evolution	1st	6
V02G031V01102	Physics: Physics of biological processes	1st	6
V02G031V01103	Geology: Geology	1st	6
V02G031V01104	Mathematics: Mathematics applied to Biology	1st	6
V02G031V01105	Chemistry: Chemistry applied to biology	1st	6
V02G031V01106	Biology: Soil, aquatic environment and climate	2nd	6
V02G031V01107	Statistics: Biostatistics	2nd	6
V02G031V01108	Biology: Basic laboratory techniques	2nd	6
V02G031V01109	Biology: Basic field techniques	2nd	6
V02G031V01110	Biology: Informatic tools in biology	2nd	6

IDENTIFYING DATA				
Biology: Evolution				
Subject	Biology: Evolution			
Code	V02G031V01101			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Rolán Álvarez, Emilio			
Lecturers	Díez Ferrer, José Bienvenido Megías Pacheco, Manuel Navarro Echeverría, Luis Rolán Álvarez, Emilio Velando Rodríguez, Alberto Luís			
E-mail	rolan@uvigo.es			
Web	http://http://evolucion.webs7.uvigo.es/index.html			
General description	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			
WEB PAGE of divulging where find good part of the contents of the matter				

Training and Learning Results	
Code	
A1	Students should prove understanding and knowledge in this study field that starts in the Secondary Education and with a level that, even though it is supported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.
A2	Students should know how to apply their knowledge to their work or vocation in a professional way. They also should have the competences that are usually proved through the elaboration and defence of arguments and the resolution of problems within their study field.
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.
B6	Develop analysis and synthesis, critical reasoning and argumentation skills, applying them in Biology and other scientific-technical disciplines.
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.
C2	Identify levels of organisation of living beings through the study of current specimens and fossils. Carry out phylogenetic analyses and study the mechanisms of heredity, evolution and biodiversity.
C6	Understanding and integrate the functioning of living beings (cellular, tissue, organ and individual level), explaining their homeostatic and adaptive responses.
C7	Sampling, characterising, cataloguing and managing natural and biological resources (populations, communities and ecosystems).
D3	Commitment to sustainability and the environment. Equal, sensible and efficient use of resources.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Recognise the proofs that confirm the existence of biological evolution.	A1 B2 C7 D3 A2 B6
Recognise the mechanisms that determine the biological evolution.	A1 B2 C2 B6
Gather an integral vision of the history of the life and of his moments more determinants by means of the study of the register fossil and the current organisms.	B2 C6
Recognise the main hypotheses and existent proofs in relation to the evolution of our own species.	A1 B2 A2 B6
Recognise, examine, and identify specimens fossils and his applications.	A1 B2 C7
Identify and give to know the adaptations of the living beings.	A1 C1 A2 C6
Recognise the social projection of the evolution and his repercussion in the professional exercise, as well as know give to know his contents to give teaching and during his divulging.	A1 B6
Recognise and reproduce the concepts and own basic terminology of the evolutionary theory.	A1 B6

Contents	
Topic	
Introduction (3 hours)	<p>1. Evidences on the evolution. Concept of Evolution. Evidences of the fact of the evolution.</p> <p>2. History of the evolutionary ideas. From the antiquity until the modernity. Charles Darwin and the eclipse of the Darwinism. The modern evolutionary synthesis. The evolution in the century 20. The actuality.</p> <p>3. Evolution and society. Current applications of the evolutionary theory. The evolution and the religion.</p>
The evolutionary mechanisms (10 hours)	<p>4. Introduction to the evolutionary theory. Structure of the theory. Mutations. It derives genetic. Migration. Natural selection.</p> <p>5. Natural selection and adaptation. The characters object of the selection. Some basic concepts: natural selection, biological efficiency and adaptation. *Plasticidad *fenotípica And adaptation. Types of natural selection.</p> <p>6. Measure of the natural selection. The natural selection and his practical decomposition in components. The measure of the selection in qualitative characters. The measure of the selection in quantitative characters. The sexual selection and his measure. Potentiality and limit of the natural selection.</p> <p>7. Cooperation and conflict. The cooperation and the altruism. The study of the evolutionary conflict.</p>
The species and his evolutionary interactions (3 hours)	<p>8. Species and speciation. Concept of species and of reproductive isolation. The measure of the reproductive isolation. The origin of species.</p> <p>9. Coevolution. Interactions between species and natural selection. Negative Coevolution: predation, parasitism and competition. *Positive Coevolution: mutualism and symbiosis.</p> <p>10. Evolution and development. Deveolpment in model organisms. Evo-Devo tools. Evo-Devo example. Canalization and convergence.</p>
I register fossil (4 hours)	<p>11. Nature and meaning of the register fossil. Importance and representativeness of the register fossil.</p> <p>12. Relation between the history of the life and the earth. The main biological events along the geological history.</p>
Origin and diversification of the life (9 hours)	<p>13. The origin of the life. Data theories and problems.</p> <p>14. The tree of the life. Tools and methods of inference.</p> <p>15. Bacteria, arch and eukaryotic. Evolutionary relations.</p> <p>16. Origin and diversification of multicellular organisms. Origin and consequences of the multicellularity.</p> <p>17. Macroevolution. Patterns and explanation of the macroevolution.</p>
Human evolution (6 hours)	<p>18. The human lineage: evolutionary history of primates and hominids. I register fossil and studies of ancient genetic material.</p> <p>19. Evolution and diversity of human characters. Brain and language, Theory of the mind. Vital strategies: evolutionary commitments, senescence.</p> <p>20. Social evolution in hominids. Systems of mating and sexual selection. Familiar selection. Cooperation and altruism.</p>

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	13	26	39
Studies excursion	3	6	9
Lecturing	36	54	90

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practical	<p>They will make practices of 3 or 4 hours each one:</p> <ol style="list-style-type: none"> 1. Recognition and interpretation of the register fossil (3 hours). The students will confront to a real stratigraphic series, with included fossils in his taphonomic environment and will have to learn the keys of his interpretation. 2. Phylogenetic analysis (3 hours). The main aims of the activity is that the students learn to apply the tools but simple of phylogenetic analysis. For this used a small group of data of different species, and selecting the characters, will expose a phylogenetic hypothesis of this group of organisms, with the end to make the evolutionary interpretations between the groups. 3. Human evolution (4 hours). One of the main tools of the human evolution is the comparison of skulls of different hominid species. The practice will allow that the students infer the evolutionary relations in the human lineage using a collection of replies of skulls fossils. Besides, it will retort an experiment on social selection in humans with the end to know and interpret the evolutionary studies on the human behaviour. 4. Practice of visualisation of videos (3 hours). Format of audiovisual communication and evolutionary divulging. Viewing of series of evolutionary videos. Discussion and review of concepts and evolutionary mechanisms. Preparation of report of understanding of the videos visualised by the student. Explanation of the protocol of preparation of scripts to make short videos. Preparation, by part of the student, of a script for an evolutionary video.
Studies excursion	The students displaced to a zone of the intertidal rocky shore (Coast of Cape Estai) with the instruction to observe copulas in situ of one or several species to be able to estimate the component of sexual efficiency for any trait of easy determination as it is the colour of the shell. Also they will study for the same characters the frequency of the same in different stadiums of the cycle of life, with the instruction to estimate the component of feasibility.
Lecturing	The matter of the lecturer will be taught to students by means of magistral classes, prepared with the presentation of some occasional professional video. The students will be presents in shape of an alone face-to-face group. In the educational platform will be able to have of didactic material of support, presentations in pdf, etc. Also will have of the information (still is not complete) explained in shape of text and images in the web page that is developing for the subject: http://evolucion.webs7.uvigo.es/

Personalized assistance

Methodologies	Description
Studies excursion	The students will have of time of *tutoría of skilled attention, with schedules and location described for each professor in the educational platform, where will be able to clear doubts arisen during the realisation of the exit of study.
Lecturing	The students will have of time of *tutoría of skilled attention, with schedules and location described for each professor in the educational platform, where will be able to clear doubts arisen during the masterclasses.

Assessment

	Description	Qualification	Training and Learning Results	
Laboratory practical	The responsible professor will evaluate each practice by means of report written, survey or practical work depending on each case.	20	B2 B6	C1 C2 C6 C7
Studies excursion	The evaluation will make by means of an individual survey made in the corresponding educational platform	5	B2 B6	C1 C2 C3
Lecturing	At the end of course will make a type test prove (preferably) but that also can carry any practical problem.	40	A1 A2	B2 B6 C1 C2 C6
Objective questions exam	You will make 2 partial, to half of course and at the end (before the final proof type test (see Lecturing). In this case they will do questions, preferably, of concept and of short answer.	35	B2 B6	C1 C2 C6

Other comments on the Evaluation

CONTINUOUS EVALUATION:

This is the normal way of evaluation and the system has been designed to obtain the better qualifications. The assistance to Laboratory practice (field excursion as well) and to the Objective question exam is COMPULSORY, lose some practice or partial without justification. It could be sufficient reason to fail the final evaluation of the same.

The model of normal evaluation goes through to present to:

1. Practices (including gone out of study) and his corresponding method of evaluation.
2. Partials (Objective question exams). These are two exams from different contents of the lecture.
3. Lecturing Final (including all contents of the lecture).

To pass the lecture any student may get a minimum qualification of 5 in average and larger than 3 in any part.

SECOND OPORTUNITY:

The second opportunity exam is a new final test exam, while the rest of qualifications (Practice, Partials) will be hold during the same course.

GLOBAL EXAM:

Nevertheless, It may be possible to do just a final writting exam for the whole former activities. However, this may be agreed with the lecture coordinator at the beginning of the course (before the deadline existing in the faculty). This final alternative consist in a single written exam that included evaluation of all the former parts: laboratory practices, studies excursion, lecturers, Objective question exams, etc). This exam will be presented in the same dates than the final exam dates (first and second option). To pass the student may get larger than 5 in average and alrger than 3 in any part.

EXAM DATES AND TIMES:

The times of the course activities can be obtained from the Faculty WEB page: <https://bioloxia.uvigo.es/es/docencia/horarios/>

The dates and classrooms of the examinations will appear in the following WEB direction from the start of the course: <http://bioloxia.uvigo.es/es/docencia/examenes/>

Sources of information

Basic Bibliography

Megias, Gefaell y Rolán-Alvarez, **Evolución**: <http://evolucion.webs7.uvigo.es/index.html>, Universidade de Vigo, actualización contin

Complementary Bibliography

Freeman y Herron, **Análisis evolutivo**, 2 edición, Pearson Educación, 2002

Futuyma, **Evolution**, 2 Edición, Sinauer associates, 2009

Boyd y Silk, **How Humans Evolved?**, 4 Edición, Norton and co., 2005

Fontdevila y Moya, **Evolución: origen, adaptación y divergencia de las especies**, 1 Edición, Síntesis, 2003

Dopazo y Navarro, **Evolución y adaptación: 150 años después del origen de las especies**, Obra propia (difusión gratuita), 2009

Saetre y Ravinet, **Evolutionary Genetics**, 1 Edición, Oxford, 2019

Recommendations

Subjects that continue the syllabus

Genetics I/V02G031V01209

Zoology 1: Non-arthropod invertebrates/V02G031V01205

Zoology 2: Arthropod invertebrates and chordates/V02G031V01210

Ecology II/V02G031V01306

Genetics II/V02G031V01304

IDENTIFYING DATA				
Physics: Physics of biological processes				
Subject	Physics: Physics of biological processes			
Code	V02G031V01102			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulla Miguel, Ana María			
Lecturers	Mato Corzón, Marta María Ulla Miguel, Ana María			
E-mail	ulla@uvigo.es			
Web				
General description	<p>To know the biological phenomenology from the Physics laws and principles, that will allow student to analyze and interpret the environment, as well as to understand the design of biological process models.</p> <p>To understand the fundamental physical concepts in order to understand the working principles of instruments and their application to different measurement and control techniques. To analyze and interpret the adaptations of living beings to their environment, terrestrial or external, as well as their behavior using physical or astrobiological laws and concepts.</p> <p>English Friendly subject: International students may request from the teachers:</p> <p>a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.</p> <p>Also, it makes use of the MOOVI teleteaching platform.</p>			

Training and Learning Results				
Code				
A1	Students should prove understanding and knowledge in this study field that starts in the Secondary Education and with a level that, even though it is supported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.			
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.			
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.			
B6	Develop analysis and synthesis, critical reasoning and argumentation skills, applying them in Biology and other scientific-technical disciplines.			
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.			
C3	Perform and interpret molecular, physicochemical and biological analyses, including samples of human origin. Conduct assays and functional tests under normal and abnormal conditions.			
C6	Understanding and integrate the functioning of living beings (cellular, tissue, organ and individual level), explaining their homeostatic and adaptive responses.			
C8	Describe, assess and plan the physical environment, use bio-indicators and identify environmental problems. Provide solutions for the control, monitoring and restoration of ecosystems.			
D1	Understand the meaning and use of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a fairer and more equal society.			
D2	Communicate speaking and in writing in Galician.			
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
To understand the biological phenomenology from the Physical Laws and Principles, in order to analyze and interpret their meanings, as well as to try to understand the design of models of biological processes.	A1	B2 B6	C1 C6	D1 D2
Comprise the fundamental physical concepts to understand the working principles of instruments, together with their application to distinct techniques of measure and control.	A1 A3	B2 B6	C1 C8	D1 D2 D4

To analyze and interpret the adaptations of living entities to the terrestrial or external media, and their behaviour by means of the laws and physical or astrobiological concepts.	A3	B6	C3 C6	D1 D2 D4
To apply Physics knowledge to comprise how to evaluate and solve physical problems, that may contribute to diagnose and sort out environmental problems.	A1 A3	B2 B6	C1 C8	D2 D4
To comprise the social projection of Physics and its repercussion on the biological or astrobiological contexts.	A3	B6	C8	D1 D2
To know and handle concepts, terminology and scientific or technical instrumentation, relative to this subject entitled "Physics of Biological Processes".	A1 A3	B2 B6	C1	D2 D4

Contents

Topic	
0. Review topics	0.1 Introduction 0.2 Magnitudes 0.3 Units 0.4 Conversions
1. Biomechanics	1.1 Principles of the movement 1.2 Types of movement 1.3 Balance 1.4 Forces and moments
2. Laws of Thermodynamics	2.1 Heat and temperature 2.2 Principles of Thermodynamics 2.3 Heat transmission
3. Fluids	3.1 Fluid Statics 3.2 Surface phenomena 3.3 Fluid Dynamics 3.4 Movement of bodies inside a fluid
4. Waves	4.1 Wave properties 4.2 Sound Waves 4.3 Electromagnetic waves
5. Optics	5.1 Optics principles 5.2 Geometric Optics 5.3 Lenses
6. Radiation and radioactivity	6.1 Nucleus and particles 6.2 Natural Radioactivity 6.3 Radioactivity applications
7. Astrobiology	7.1 The bases of life in the Universe 7.2 The search for life in the Solar System and in exoplanets
Program of laboratory practices	Theory of errors and their evaluation (previous knowledge) 1. Length and area measurements 2. Density measurements of solids and liquids 3. Viscosity measurements in a liquid 4. Surface tension measurements in a liquid 5. Specific heat measurements by the method of mixtures 6. Springs 7. Lenses

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	8	6	14
Laboratory practical	20	20	40
Mentored work	0	10	10
Lecturing	20	30	50
Autonomous problem solving	0	20	20
Essay questions exam	2	12	14
Self-assessment	0	2	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Seminars	Seminars/problems classes: problems on practical cases of application of the theory and numerical data, will be treated employing the required mathematical tools and/or necessary computing settings.

Laboratory practical	Practical laboratory classes: will be held in the Physics laboratory 21 block C, 3rd floor. Each practice has a script that, prior to execution, will be given to each student. The results obtained after carrying out each practice in the laboratory will be delivered by the students for evaluation.
Mentored work	Group work: a group work will be carried out on physical aspects applied to Biology.
Lecturing	Theoretical lectures: they will be given in a classroom and, in them, the theoretical contents of the program will be developed.
Autonomous problem solving	The problems with resolution of autonomous form will be proposed how reinforcement, and will be about similar practical cases to the ones treated in the context of seminars and practical sessions.

Personalized assistance

Methodologies	Description
Laboratory practical	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.
Lecturing	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.
Seminars	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.
Mentored work	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.
Autonomous problem solving	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.
Tests	Description
Essay questions exam	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.
Self-assessment	If needed, personalized assistance can take place by means of previous appointment at the teachers' offices, or by ICT means.

Assessment

	Description	Qualification	Training and Learning Results			
Seminars	Seminar activities complement the knowledge of the different parts and are evaluated in each one. The assessment is partly performed in the written essays and/or examinations.	4	A1 A3	B2 C1 C8	D1 D2	
Laboratory practical	Laboratory practices and the result of practices is 20% of the mark.	20	A1 A3	B2 B6 C3 C6	D2 D4	
Mentored work	There will be a group work, including an oral presentation of it, that represents 15% of the mark.	15	A1 A3	B2 B6 C1	D1 D2 D4	
Lecturing	The contents exposed in the theory lessons suppose an important part of the global note. Its evaluation will be integrated in the context of the test assignments and/or examinations, accounting for 20%. There are two theory tests that can free matter, but each of them owed to be surpassed with one minimum of 4 points on 10, so that they are taken into account in the continuous evaluation.	20	A1	B2 C6	D2	
Essay questions exam	Problems suppose an important part of the global note. Its evaluation will be integrated in the context of the test assignments and/or examinations, accounting for 38%. There are two problems tests that can free matter, but each of them owed to be surpassed with one minimum of 3,5 points on 10, so that they are taken into account in the continuous evaluation.	38	A1 A3	B2 B6 C1	D1 D2	
Self-assessment	A self-assessment writing will be up to 3% of the mark.	3	A1 A3	B6 C1	D1 D2 D4	

Other comments on the Evaluation

CONTINUOUS EVALUATION:

Evaluation will be made by means of the sum of the marks for four written tests (two for theory and two for problems), laboratory practices, a self-evaluation written report and a group work to be exposed in class. All practical activities of this subject (in laboratory, classroom informatics, seminars, etc.) are considered of experimental nature.

Theory tests account for 20% of the global note; problem tests, 38%; laboratory practices, 20%; self-evaluation, 3%; seminars, 4%; and the group work, together with its corresponding oral exposition, 15%. Each theory or problems test owes to be surpassed with a 4 or 3,5, respectively, on 10 for power do average in the continuous evaluation system. The 1st theory test together with the 2nd problems one, can be compensated to obtain a minimum of 5 points (passed). Equally for the 3rd (theory) and 4th (problems) tests. Any of them that do not surpass 3,5 or 4, correspondingly, points on 10 --and that could not had been compensated-- must be passed, with a minimum mark of 5, in the final examination of the subject. That final examination is NOT to go up mark, since all the tests free matter along the course in continuous evaluation system. Attending to seminars, and the realization and delivery of all the practices, are mandatory to pass the subject.

N.P.: Those students that do not attend any of the punctuable tests. Those who do not present or do not deliver any of the punctuable tests/practices/works/expositions will receive as course mark the average weighed marks obtained, but pondered by a factor 0,5.

2nd OPPORTUNITY:

The same applies in the July examination.

GLOBAL EVALUATION:

Students can communicate, during the 1st course month , their renounce to the continuous evaluation system. In that case, the realization and delivery of all the practices, are mandatory to pass the subject anyway.

EXAMINATION DATES FOR COURSE 2023-2024 IN THE FACULTY WEB (#http://bioloxia.uvigo.es/*gl/*docencia/examinations)

COURSE TIMETABLES: <http://bioloxia.uvigo.es/es/docencia/horarios/>

Sources of information

Basic Bibliography

Simon Mochrie , Claudia De Grandi, **Introductory Physics for the Life Sciences**, Springer, 2023

David V. Guerra, **Introductory Physics for the Life Sciences: Volumes I and II**, Routledge Taylor & Francis Group, 2023

Complementary Bibliography

A. Cromer, **Física para las ciencias de la vida**, Ed. Reverté, 1991,

D. Jou, E. Llebot, C. Pérez García, **Física para Ciencias de la Vida**, Ed. McGraw Hill, 1994,

Hugh D. Young, Roger A. Freedman, **Física universitaria : con física moderna**, Pearson Educación, 2018,

Philip Nelson, **Física biológica : energía, información, vida**, Reverte, cop. 2005,

J.A. Fidalgo, M. Fernández, **Física general**, Everest, D.L. 2000,

Álvaro Giménez Cañete et al., **Astrobiología : sobre el origen y evolución de la vida en el universo**, Los Libros de la Catarata : CSIC, 2011,

Carlos Briones Lorente, **¿Estamos solos?**, Editorial Crítica, 2020,

Emilio J. Sánchez Barceló, **Hicimos la luz... y perdimos la noche : efectos biológicos de la luz**, Universidad de Cantabria, 2017

Recommendations

Other comments

The general schedules/timetables can be found in the WEB page of the FACULTY OF BIOLOGY:

<http://bioloxia.uvigo.es/en/teaching/timetables/>

IDENTIFYING DATA				
Geology: Geology				
Subject	Geology: Geology			
Code	V02G031V01103			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Francés Pedraz, Guillermo			
Lecturers	Alejo Flores, Irene Diz Ferreiro, Paula Francés Pedraz, Guillermo Gil Lozano, Carolina González Villanueva, Rita Pérez Arlucea, Marta María			
E-mail	gfrances@uvigo.gal			
Web	http://bioloxia.uvigo.es/es/			
General description	<p>English Friendly subject: International students may request from the teachers:</p> <p>a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.</p> <p>In this matter, the basic functioning of the physical environment in which the current biosphere sits and develops is analysed. Because of that, the sedimentary environments (continental, coastal and marine) are studied from Actualism point of view. It allows laying the foundations for understanding the interaction of living beings with the environment in which they inhabit. From this point of view, the subject provides a primary and complementary knowledge of the concepts developed in other subjects, especially those related to Zoology, Botany and Ecology.</p> <p>Likewise, the introduction of the temporal dimension allows raising the basic questions about the origin and evolution of the Earth System in general, and of the biosphere in particular. These aspects will favour the understanding of the concepts related to biodiversity and organic evolution, as well as with the organisation and evolution of populations and ecosystems.</p> <p>Biology professionals, as well as other sciences, often develop their work in multidisciplinary teams, so the biologist must know the terminology and basic concepts of Geology that apply to different professional skills of these graduates. More specifically, professionals who develop their functions in the field of the environment, agricultural professionals, or those dedicated to information, documentation and dissemination should handle geological concepts that allow them to exchange information with other professionals, understand biological processes from a global point of view and make better decisions.</p> <p>A particular impact of Geology on the biologist's professional profile concerns teaching at the middle level. According to the structure and contents of entrance exams, future teachers must acquire knowledge and skills related to Geology.</p> <p>The schedules can be consulted at: http://bioloxia.uvigo.es/es/docencia/horarios/</p>			

Training and Learning Results	
Code	
A1	Students should prove understanding and knowledge in this study field that starts in the Secondary Education and with a level that, even though it is supported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.
B1	Developing autonomous learning by identifying their own training need and organizing and planning tasks and time.
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.
B4	Draft and write reports, documents and projects related to Biology. Proceed to their presentation and debate in the teaching and specialized areas, highlighting the competences of the degree.
C7	Sampling, characterising, cataloguing and managing natural and biological resources (populations, communities and ecosystems).
C8	Describe, assess and plan the physical environment, use bio-indicators and identify environmental problems. Provide solutions for the control, monitoring and restoration of ecosystems.
C12	Writing reports and technical dossiers, as well as directing and executing projects on topics related to biology and its applications.
D3	Commitment to sustainability and the environment. Equal, sensible and efficient use of resources.
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.
D5	Communicate effectively and appropriately, including the use of computer tools and English.

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Recognize the overall functioning of the Earth system.	A3	B2	C8	D3
Describing the geological cycle.	A3	B2	C8	D3
Define, describe and relate the theory of global tectonics.	A3	B2	C8	D3 D5
Defining the principles of geology.	A3	B2	C8	D5
Recognize the historical dimension of geology.	A3	B2	C8	D3 D5
Identifying external and internal geological processes.	A3	B2	C7 C8	D3
Identifying the fundamental types of rocks and their origin.	A1	B2 B4	C8 C12	D4
Recognize the morphological and sedimentary characteristics of terrestrial, coastal and marine environments.	A3	B2 B4	C7 C8 C12	D3 D4
Relating the abiotic factors of the environment with living beings.	A1 A3	B2 B4	C7 C8 C12	D3 D4 D5
Relating knowledge and techniques of geology to interpret cartography.	A1	B4	C7 C12	D4
Gathering information, reproducing experiments and showing the results in the field of Geology.	A3	B1 B2 B4	C12	D3 D4 D5
Recognize the usefulness of geology and its repercussions on the professional practice of biologists.	A1	B2 B4	C12	D3 D4
Defining and relating the concepts, terminology and scientific-technical instrumentation related to geology.	A1	B2 B4	C8 C12	D4

Contents

Topic	
1. Concept and Principles of Geology	Geology, a Earth science Historical and Physical Geology Principles of Geology
2. Coordenates in Geología	Spatial coordenates Geological time
3. The rocks cycle	Concept Classification of rocks and its relationship with the rocks cycle External cycle Internal cycle
4. The Atmosphere and the Hydrosphere	The Atmosphere: origin, composition, structure and dynamics. Ocean water and its dynamics. Continental waters: the Hydrological cycle
5. Continental environments	Glacial environment Dessert environment Alluvial systems Lacustrine environment
6. Coastal environments.	Coastal areas: agents and sedimentary processes. Erosive coasts. Coastal sedimentation: beaches, deltas, estuaries, tidal flats.
7. Marine and ocean regions.	Morphology and distribution of marine bottoms. Continental shelf. Reefs Deep-sea environments
8. Global Tectonics.	Continental drift Internal structure of the Earth Seafloor spreading Plate Tectonics
9. Practice Sessions	Recognition of rocks and deformation structures. Geomorphology and sedimentary environments from South Galicia coastal zone Concepts on cartography. Introduction to Geological maps.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	1.5	2
Lecturing	27	45	72
Seminars	1	24	25
Field practice	8	3	11
Presentation	2	13	15
Laboratory practical	9	12	21
Report of practices, practicum and external practices	0	1	1
Essay questions exam	2	0	2
Problem and/or exercise solving	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Introductory activities	Introduction to course: schedule, contents, practices, evaluation.
Lecturing	Presentations in the classroom on the concepts and fundamental contents of the subject. Student participation will be stimulated through questions, group resolution of exercises, etc.
Seminars	Preparation of a report on a subject related to Geology, chosen from a list proposed by the teaching staff. The students have the option of selecting a topic that is of interest to them, but it must be consulted and approved by the faculty. To prepare the report, the students will receive the appropriate advice in a face-to-face session at the beginning of the course and through personalised attention during the rest of the semester.
Field practice	Field trip to recognize different types of rocks, tectonic structures and various sedimentary environments. Learn to use the geological compass. Preparation of an evaluable activity report, which will be uploaded to Moovi.
Presentation	Oral presentation of the contents of the report prepared in the seminars. The students will receive advice on how to structure, prepare a presentation and expose the work through personalised attention sessions
Laboratory practical	Guided resolution of exercises on topography and basic geological cartography. Geological outcrops. Evaluation through a face-to-face test in the classroom.

Personalized assistance

Methodologies	Description
Lecturing	Resolution of doubts through individualised or group tutorials, both face-to-face and remote or by email. It is recommended that students contact the teaching staff by email sufficiently in advance to make an appointment.
Introductory activities	Resolution of doubts through individualised tutorials. It is recommended that students contact the teaching staff by email, sufficiently in advance to make an appointment
Field practice	In situ instructions for the management of the geological compass, criteria for rock recognition, identification of sedimentary environments in current environments
Laboratory practical	Explanation and advice for solving simple geological cartography exercises in small groups. For tutorials, it is recommended that students contact the faculty by email, sufficiently in advance to make an appointment.
Seminars	Detailed instructions on how to file a report. Consultation of specialized databases. Advice on the choice of a theme to develop in the report. Resolution of doubts through individualised tutorials. It is recommended that students contact the teaching staff by email sufficiently in advance to make an appointment.
Presentation	Detailed instructions on organising an oral presentation and the resources available. Resolution of doubts through personalised tutorials. It is recommended that students contact the teaching staff by email sufficiently in advance to make an appointment.
Tests	Description
Report of practices, practicum and external practices	Detailed instructions on the content and how to submit a report. Presentation of data through tables and figures. Search information in the net. Resolution of doubts through individualised tutorials.
Essay questions exam	Resolution of doubts through personalized tutorials
Problem and/or exercise solving	Resolution of doubts through individualised tutorials. It is recommended that students contact the teaching staff by email sufficiently in advance to make an appointment.

Assessment

	Description	Qualification	Training and Learning Results			
Seminars	The written report on a subject related to the subject chosen by each group of students is evaluated. The content, the inclusion of additional documentation, the presentation, graphics, diagrams, photographs, etc., are valued. The evaluation criteria will adjust to the contents of the rubric of the TFG proposed by the faculty (not to the percentages).	20	A3	B1 B2 B4	C12	D3 D4 D5
Presentation	Items to evaluate: Structure and quality of the presentation. Adjust to the set time. Use of language with scientific rigor. Attitude during the presentation	20	A3	B2 B4	C8 C12	D3 D4 D5
Report of practices, practicum and external practices	They are evaluated in a similar way to the contents of the TFG rubric proposed by the faculty: The structure and quality of the presentation. Stick to the set time. The use of language with scientific rigour. The attitude during the presentation. The quality of the responses to the questions posed.	10	A3	B4	C8 C12	D3 D4 D5
Essay questions exam	Written exam of a theoretical-practical nature on the fundamental contents of the subject.	35	A1 A3	B2 B4	C8 C12	D3
Problem and/or exercise solving	A test will be carried out to solve one or several practical exercises.	15	A1 A3	B2	C12	D5

Other comments on the Evaluation

It is recalled that attendance at face-to-face activities is mandatory.

As a general rule, the evaluation at the first opportunity will be continuous. To pass the subject it will be necessary to achieve a score of at least 40% of the individual evaluation of the seminars, the presentation and the examination of development questions. In case of not reaching said 40% in any of these three tests, the final mark will be equal to the final weighted average, multiplied by 0.5.

GLOBAL EVALUATION METHOD: It must be requested by each student in the form and term indicated by the center. It will consist of a single theoretical-practical exam that will account for 100% of the evaluation.

SECOND CHANCE EVALUATION: It will consist of a single theoretical-practical exam that will account for 100% of the evaluation.

Students who take this subject are required to behave responsibly and honestly (See Title VII of the Regulations on the evaluation, qualification and quality of teaching and the student learning process).

Dates of the tests and delivery of reports, according to the official calendar of the

faculty: <https://bioloxia.uvigo.es/es/docencia/horarios/> and <https://bioloxia.uvigo.es/es/docencia/examenes/>

Sources of information

Basic Bibliography

Pozo, M., González, J. y Giner, J., **Geología Práctica**, 1, Pearson, 2004

Monroe, J.S., Wicander, R. y Pozo, M., **Geología. Dinámica y Evolución de la Tierra**, 4, Paraninfo, 2008

Tarback, E.D., Lutgens, F.K., Tasa, D., **Ciencias de la Tierra. Una introducción a la Geología Física**, 10, Pearson, 2013

Reolid, M., **La Tierra: un lugar privilegiado para la vida**, 1, Aula Magna Proyecto clave McGraw Hill, 2020

Wicander, R. & Monroe, J.S., **Geology: Earth in Perspective**, 3, CENGAGE, 2019

Complementary Bibliography

Recommendations

IDENTIFYING DATA**Matemáticas: Matemáticas aplicadas á bioloxía**

Subject	Matemáticas: Matemáticas aplicadas á bioloxía			
Code	V02G031V01104			
Study programme	Grao en Bioloxía			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Castelán Galego			
Department				
Coordinator	Sanmartín Carbón, Esperanza			
Lecturers	Sanmartín Carbón, Esperanza			
E-mail	esanmart@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	O obxectivo fundamental da materia é proporcionarlles aos alumnos os coñecementos matemáticos básicos que precisarán na súa formación e exercicio profesional.			
	O enfoque da materia é eminentemente práctico, centrándose na comprensión e nas aplicacións dos resultados matemáticos necesarios para a resolución de problemas que se presentan na Bioloxía, polo que se establecerán os resultados, en xeral, sen demostración, aínda que se manterá un alto nivel de rigor na formulación, enunciado, análise de hipóteses e consecuencias.			

Resultados de Formación e Aprendizaxe

Code	
A2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo.
A3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética.
B1	Desenvolver a aprendizaxe autónoma, identificando as súas propias necesidades formativas e organizando e planificando as tarefas e o tempo.
B2	Xestionar información científico-técnica de calidade utilizando fontes diversas. Analizar datos e documentos e interpretalos de forma crítica e rigorosa, incluíndo reflexións sobre a súa relevancia social e no ámbito profesional da Bioloxía.
B6	Desenvolver as capacidades de análises e sínteses, de razoamento crítico e argumentación, aplicándoas en contextos propios da Bioloxía e outras disciplinas científico-técnicas.
C1	Resolver problemas aplicando o método científico, os conceptos e a terminoloxía específica da Bioloxía, os modelos matemáticos e as ferramentas estatísticas e informáticas.
C7	Muestrear, caracterizar, catalogar e xestionar recursos naturais e biolóxicos (poboacións, comunidades e ecosistemas).
C10	Identificar procesos biolóxicos e biotecnolóxicos e a súa posible aplicabilidade, en particular nos ámbitos sanitario, agroalimentario e ambiental.
D1	Comprender o significado e aplicación da perspectiva de xénero nos distintos ámbitos de coñecemento e na práctica profesional co obxectivo de alcanzar unha sociedade máis xusta e igualitaria.
D5	Comunicar de maneira eficaz e adecuada, incluíndo o uso de ferramentas dixitais e o inglés.

Resultados previstos na materia

Expected results from this subject	Training and Learning Results			
Aplicar as técnicas básicas do álgebra lineal no ámbito da Bioloxía.	A3	B1 B2 B6	C1 C7 C10	D5
Aplicar a derivación parcial e a diferenciabilidade ao estudo dunha función.	A3	B1 B2 B6	C1 C7 C10	D5
Aplicar as técnicas básicas do cálculo integral no ámbito da Bioloxía.	A3	B1 B2 B6	C1 C7 C10	D5
Manexar algún programa informático de utilidade na resolución de problemas relacionados coa materia.	A3	B1 B2 B6	C1 C10	D5

Saber aplicar coñecementos e técnicas matemáticas a procesos e estudos biolóxicos e biotecnolóxicos.	A2 A3	B1 B2 B6	C1 C7 C10	D5
Analizar a información, interpretar os resultados numérica e gráficamente, e obter as conclusións.	A2 A3	B1 B2 B6	C1 C7 C10	D1 D5
Coñecer e manexar a linguaxe matemática e a súa aplicación no ámbito de Bioloxía.	A2 A3	B1 B2 B6	C1 C7 C10	D1 D5

Contidos

Topic

TEMARIO DA MATERIA

1. O ESPAZO R^n :

O espazo vectorial R^n . Matrices e determinantes.

Aplicacións lineais: matriz asociada. Producto escalar, norma e distancia. Formas cadráticas.

2. INTRODUCCIÓN AO CÁLCULO DIFERENCIAL:

Cuestións básicas de funcións reais. Derivación de funcións dunha variable. Derivadas direccionais e derivadas parciais. Diferencial dunha función: matriz jacobiana e vector gradiente. Regra da cadea. Plano tanxente. Derivadas sucesivas. Extremos dunha función escalar.

3. INTRODUCCIÓN AO CÁLCULO INTEGRAL:

Cálculo da área dunha rexión plana limitada por curvas. Teorema fundamental do cálculo integral. Primitivas.

TEMARIO DE PRÁCTICAS DE ORDENADOR

1. Toma de contacto co programa de cálculo

MAXIMA. Álgebra lineal.

2. Funcións dunha e varias variables.

Representación gráfica e a súa interpretación.

3. Aplicacións do cálculo diferencial. Integración e as súas aplicacións.

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0.5	1.5
Lección maxistral	20	20	40
Resolución de problemas	18	42	60
Prácticas con apoio das TIC	6	2	8
Resolución de problemas e/ou exercicios	3	12	15
Exame de preguntas obxectivas	2	23.5	25.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Metodoloxía docente

	Description
Actividades introdutorias	Explicarase a guía docente da materia. O horario pódese consultar en http://bioloxia.uvigo.es/gl/docencia/horarios
Lección maxistral	Desenvolveranse os contidos necesarios para a adecuada comprensión do programa, facendo fincapé nos aspectos que poidan resultar máis dificultosos. O horario pódese consultar en http://bioloxia.uvigo.es/gl/docencia/horarios
Resolución de problemas	Nas prácticas de encerrado realizaranse exercicios que lle permitirán ao alumno afianzar os conceptos teóricos, así como a súa aplicación, e resolveranse as dúbidas que poidan xurdir. O horario pódese consultar en http://bioloxia.uvigo.es/gl/docencia/horarios
Prácticas con apoio das TIC	Tres sesións de dúas horas cada unha, nas que se usará o programa Maxima de software libre para a resolución de problemas relacionados coa materia. O horario pódese consultar en http://bioloxia.uvigo.es/gl/docencia/horarios

Atención personalizada

Methodologies	Description
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Resolución de problemas	Atención ás preguntas e dúbidas formuladas polos alumnos nas clases prácticas ou en tutorías. O HORARIO DE TUTORIAS pódese consultar en https://moovi.uvigo.gal
Lección maxistral	Atención ás preguntas e dúbidas formuladas polos alumnos nas clases teóricas ou en tutorías. O HORARIO DE TUTORIAS pódese consultar en https://moovi.uvigo.gal

Avaliación				
	Description	Qualification	Training and Learning Results	
Resolución de problemas	Avaliarase o traballo nas prácticas de encerado	20	A2 A3 B6	B1 C1 D1 B2 C7 D5 C10
Prácticas con apoio das TIC	Avaliarase o traballo na aula de informática	10	A2 A3 B6	B1 C1 D5 B2 C10 C10
Resolución de problemas e/ou exercicios	Realizaranse tres probas escritas, nas que o alumno poderá utilizar todo o material non electrónico que considere necesario. Cada unha das tres probas puntuarase sobre 10. A nota final sobre 10 desta parte será a media das notas obtidas nas probas. O alumno que non se presente a unha das probas terá un cero na devandita proba. A PRIMEIRA PROBA consistirá en cuestións e exercicios relativos ao tema 1. A SEGUNDA PROBA consistirá en varios exercicios relativos ao tema 2 ata a regra da cadea. A TERCEIRA PROBA consistirá en cuestións e exercicios relativos aos temas 2 e 3. A data das probas pódese consultar nos horarios do curso http://bioloxia.uvigo.es/gl/docencia/horarios A data de cada unha das probas e a materia que entra nas mesmas pode variar para adaptarse á marcha do curso. Neste caso, os cambios serán publicados na plataforma Moovi con suficiente antelación. As preguntas tipo test serán de resposta única e con catro posibles opcións. Cada pregunta da parte tipo test contestada erroneamente restará un terzo da puntuación dunha acertada, as preguntas en branco non suman nin restan (como exemplo: Ben=+1, Blanco=0, Mal=-1/3)	30	A2 A3 B6	B1 C1 D1 B2 C7 D5 C10
Exame de preguntas obxectivas	Ao final do semestre realizarase un exame escrito que constará de preguntas curtas tipo test e exercicios a desenvolver, relativos a toda a materia vista en clase. As preguntas tipo test, do mesmo xeito que nas probas prácticas, serán de resposta única e con catro posibles opcións. Cada pregunta da parte tipo test contestada erroneamente restará un terzo da puntuación dunha acertada, as preguntas en branco non suman nin restan (como exemplo: Ben=+1, Blanco=0, Mal=-1/3) A data coincide coa data oficial da avaliación global, pódese consultar en http://bioloxia.uvigo.es/es/docencia/examenes/	40	A2 A3 B6	B1 C1 D5 B2 C7 C10

Other comments on the Evaluation

AVALIACIÓN CONTINUA

Para os estudantes que opten pola Avaliación Continua:

- Unha mala nota nas probas prácticas pode recuperarse co traballo nas prácticas de pizarra.

- A nota final será a suma das notas obtidas na resolución de problemas (20%), as prácticas con apoio das TIC (10%), a resolución de problemas e/o exercicios (30%) e o exame de preguntas obxectivas (40%).

- Considérase alumno/a presentado/a a materia aquel que, ao finalizar o curso, presentárase a máis dunha proba práctica ou ao exame final.

- SEGUNDA OPORTUNIDADE: Os estudantes, que opten pola avaliación continua e non superen a materia, poderán elixir na segunda oportunidade entre dúas opcións:

A- Manter a nota obtida na parte práctica da materia e seguir os criterios de avaliación da primeira oportunidade.

B-Renunciar á nota obtida mediante as actividades de avaliación continua e realizar un exame que avaliará todas as actividades realizadas ao longo do curso, representa o 100% da nota.

Fixarase un prazo, previo ao exame da segunda oportunidade, no que o estudante debe comunicar que opción elixe. **En caso de non recibir comunicación**, enténdese que opta pola opción A.

AVALIACIÓN GLOBAL

Os estudantes que opten pola Avaliación Global serán avaliados, NAS DÚAS OPORTUNIDADES DO CURSO, mediante un exame con preguntas tipo test e exercicios a desenvolver relativos a toda a materia.

As preguntas tipo test serán de resposta única e con catro posibles opcións. Cada pregunta da parte tipo test contestada erroneamente restará un terzo da puntuación dunha acertada, as preguntas en branco non suman nin restan (como exemplo: Ben=+1, Blanco=0, Mal=-1/3)

A data dos exames pódese consultar en <http://bioloxia.uvigo.es/es/docencia/examenos/>

IMPORTANTE

- O alumnado poderá elixir ser avaliado mediante o sistema de Avaliación Continua, ou alternativamente optar por unha proba de Avaliación Global. O alumnado poderá elixir a Avaliación Global entregando á profesora, no prazo establecido polo centro, o formulario que se poñerá en Moovi para tal fin. A elección da Avaliación Global supón a renuncia ao dereito de seguir avaliándose mediante as actividades de avaliación continua que resten e á cualificación obtida ata ese momento en calquera das actividades que xa se realizaron.

- **A avaliación por defecto é a avaliación continua.** Se o estudante non solicita segundo o procedemento e prazo establecido a avaliación global, enténdese que opta pola avaliación continua.

-Nesta materia non se tolerarán **comportamentos deshonestos**. Os comportamentos deshonestos inclúen entre outros: plaxio, copiar durante as probas ou exames e a presenza visible de calquera tipo de dispositivo electrónico non autorizado, independentemente de que este aceso ou apagado, durante as actividades avaliadas. As sancións por condutas deshonestas poden carrexar a non superación da materia.

CONDICIÓN DE USO DO MATERIAL DEPOSITADO NA PLATAFORMA: O alumnado matriculado na materia non poderá difundir, total ou parcialmente, ningún contido do curso. Este material é para uso exclusivo da materia.

Recoméndase ao alumnado ter en conta o Título VII (Do uso de medios ilícitos), do Regulamento sobre a Avaliación, a cualificación e a calidade da docencia e do proceso de aprendizaxe do estudantado

<https://secretaria.uvigo.gal/uv/web/normativa/public/normativa/documento/downloadbyhash/4904ced4d24eb81fe5715ddde2c48c59c0a7c4d624cd0e7491df7a753985ccfa>

Bibliografía. Fontes de información

Basic Bibliography

Adams, R. A., **Cálculo**, Addison-Wesley, 2009

Besada, M.; García, F. J.; Mirás, M. A.; Quinteiro, C.; Vázquez, C., **Matemáticas a la Boloñesa**, Servicio de Publicaciones de la Universidad, 2014

Besada, M.; García, F. J.; Mirás, M. A.; Quinteiro, C.; Vázquez, C., **Un mar de Matemáticas. Matemáticas para los grados de Ciencias**, Servicio de Publicaciones de la Universidad, 2016

Larson, R. E.; Edwards, B. H., **Introducción al álgebra lineal**, Limusa, 1995

Página principal de Maxima, <http://maxima.sourceforge.net/>,

Complementary Bibliography

Besada, M.; García, F. J.; Mirás, M. A.; Vázquez, C., **Cálculo diferencial en varias variables**, Garceta, 2011

Marsden, J. E.; Tromba, A. J., **Cálculo vectorial**, Addison-Wesley Iberoamericana, 1991

Neuhauser, C., **Matemáticas para Ciencias**, Prentice Hall, 2004

Piskunov, N., **Cálculo Diferencial e Integral**, Montaner y Simón, 1983

Recomendacións

Other comments

En principio, os coñecementos matemáticos adquiridos polo alumno no bacharelato deberían constituír unha base suficiente para cursar a materia. En particular, os aspectos seguintes: manexo de expresións algebraicas sinxelas, resolución de

sistemas de ecuacións sinxelos, propiedades básicas e representación das funcións elementais, cálculo práctico de derivadas e primitivas sinxelas. Convén que o alumno, que presente carencias nalgún destes aspectos, preocúpese por cubrir as mesmas, especialmente se non cursou matemáticas no último curso de bacharelato.

É aconsellable que os alumnos aborden as dificultades da materia desde o principio, polo que se fomentará a participación activa no desenvolvemento das clases e recomendarase especialmente utilizar as tutorías para expor dúbidas e dificultades a modo individual.

IDENTIFYING DATA				
Chemistry: Chemistry applied to biology				
Subject	Chemistry: Chemistry applied to biology			
Code	V02G031V01105			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Lorenzo Fernández, Paula Salonen , Laura			
Lecturers	Lorenzo Fernández, Paula Salonen , Laura			
E-mail	lauramaria.salonen@uvigo.es paula.lorenzo@uvigo.es			
Web				
General description	General chemistry oriented to Biology. Terms of English Friendly program. International students may apply to teachers: (a) materials and bibliography for the study of the subject in English, b) attending tutorials in English, c) tests and evaluations in English.			

Training and Learning Results

Code				
A1	Students should prove understanding and knowledge in this study field that starts in the Secondary Education and with a level that, even though it is supported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.			
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.			
A4	Students should be able to communicate information, ideas, issues and solutions to all audiences (specialist and unskilled audience).			
B1	Developing autonomous learning by identifying their own training need and organizing and planning tasks and time.			
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.			
B6	Develop analysis and synthesis, critical reasoning and argumentation skills, applying them in Biology and other scientific-technical disciplines.			
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.			
C12	Writing reports and technical dossiers, as well as directing and executing projects on topics related to biology and its applications.			
D1	Understand the meaning and use of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a fairer and more equal society.			
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Know and understand the molecular structure of biological compounds and the importance of intermolecular and intramolecular bonds.	A1 A3	B6		
Recognize the different types of chemical bonds, as well as their relationship with the structure of molecules and the macroscopic properties of substances.	A1 A4	B1 B6	C1	
Know general concepts about chemical reactions.	A4	B1 B2 B6		
Recognize especially the acid-base and oxidation-reduction reactions, as well as their application to biological processes.	A1 A3 A4	B2 B6	C1	
Get an overview of the chemical compounds present in Nature and their stereochemical characteristics.	A1 A3 A4	B1 B2 B6	C12	D4

Enumerate the regulations and health and safety techniques in a chemical laboratory.	A3	B6	C1 C12	D1 D4
Identify the basic material and instrumentation in a chemical laboratory.	A1 A3 A4	B1 B6	C1 C12	D1 D4
Identify and understand the basic techniques in a chemical laboratory.	A1 A3 A4	B1 B6	C1 C12	D1 D4
Know the labeling, packaging and storage procedures of chemical reagents and solvents.	A4	B1 B2 B6	C1 C12	D4
Differentiate the different types of chemical waste generated in a laboratory.	A4	B1 B2 B6	C1 C12	D4
Apply knowledge related to Chemistry in the field of Biology.	A1 A3 A4	B1 B2 B6	C1 C12	
Obtain and handle information, develop experiments and interpret the results.	A3 A4	B1 B2 B6	C1 C12	D1 D4
Understand the social projection of Chemistry and its impact on the professional practice of a biologist.	A4	B1 B2 B6		D1 D4

Contents

Topic

Topic 1. Structure of matter and chemical bond.	1. Classification of matter. Distribution of the elements in Earth and chemical composition of living matter. Molecular structure. 2. Chemical bond. Intermolecular forces in biomolecules.
Topic 2. Chemical compounds in nature. Stereochemistry.	1. Main families of chemical compounds in natural environment. 2. Chirality, stereogenic centers. Enantiomers and diastereoisomers. Tridimensional representation of the chemical structures. 3. Chemical reactions in biological environments.
Topic 3. Solution process. Colloids.	1. Types of solutions. Units of concentration. Colligative properties. Osmosis in biological processes. 2. Colloids. Structure and properties of colloidal systems.
Topic 4. Reactions and acid-base equilibrium. Redox.	1. Acids and bases. The pH. Buffer solutions. Regulation of pH in body fluids. 2. Redox reactions. Redox processes in the cellular metabolism.
PRACTICAL SESSIONS	1. SECURITY RULES IN THE CHEMICAL LABORATORY. 2. PREPARATION OF SOLUTIONS.
PRACTICE 1	LIQUID-LIQUID EXTRACTION. RECRYSTALLIZATION OF CAFFEINE.
PRACTICE 2	EXTRACTION OF LIMONENE FROM ORANGE PEEL.
PRACTICE 3	BUFFER SOLUTIONS: PREPARATION AND EVALUATION OF BUFFERING CAPACITY.
PRACTICE 4	OXIDATION-REDUCTION REACTIONS. EVALUATIONS WITH A PERMANGANATE POTASSIUM SOLUTION.
PRACTICE 5	

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	15	7	22
Seminars	10	20	30
Lecturing	23	46	69
Problem and/or exercise solving	0	15	15
Problem and/or exercise solving	2	12	14

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practical	Application of laboratory techniques in practical problems related to the subject.
Seminars	A series of proposed exercises by the teacher will be solved in the classroom.
Lecturing	Explanation of the units.

Personalized assistance						
Methodologies		Description				
Seminars	In relation to the resolution of problems and doubts that may arise on the subject, personalized attention may be requested from students (tutorials), which will be carried out by prior appointment (arranged face-to-face modality), or through the virtual office of the teachers responsible (remote campus)					
Assessment						
	Description	Qualification	Training and Learning Results			
Laboratory practical	During the laboratory practices, the teacher will evaluate both the correct application as well as the skills in the instrumental techniques developed by each student in each session. This will amount to 5% of the overall score. In addition, the student must solve, through the MOOVI platform, a questionnaire related to the concepts and techniques developed in each session. In total there will be 5 questionnaires (one for each training session), the average grade of which will contribute to 10% of the overall grade.	15				
Seminars	The teacher will propose questions or short problems (deliverables) through the MOOVI platform to be resolved throughout the four-month period (10% of the overall mark). Active participation in the seminars will contribute to 5% of the overall grade.	15	A1 A3	B2	C1	
Problem and/or exercise solving	Exam 1: There will be an exam of topics 1 and 2 during the four-month period. The exam is divided into two parts: - Multiple choice questions, which will evaluate the theoretical knowledge acquired by the student of both topics. - Problem solving part related to the subject matter of both topics.	35	A1 A3 A4	B1 B2 B6	C1	
Problem and/or exercise solving	Exam 2: There will be an exam of topics 3 and 4 at the end of the four-month period. The exam is divided into two parts: - Multiple choice questions, which will evaluate the theoretical knowledge acquired by the student of both topics. - Problem solving part related to the subject matter of both topics.	35	A1 A3 A4	B2 B6	C1	

Other comments on the Evaluation

CONTINUOUS EVALUATION:

IN ORDER TO PASS THE SUBJECT, THE STUDENT MUST OBTAIN AN OVERALL GRADE EQUAL TO OR GREATER THAN 5.

1) The continuous evaluation supposes an overall grade of the subject resulting from weighting the grade of each of the activities as indicated above (laboratory practices, seminar, problem solving and/or exercises: exams 1 and 2). Attendance at a practice session or a seminar test implies that the student is being evaluated, so their grade in the minutes cannot be "not presented".

2) The average with the grade of laboratory practices and seminar (in the indicated percentage) will only be made if the average grade of exams 1 and 2 is equal to or greater than 3.5 points. A grade lower than 3.5 supposes suspending the subject and will be the grade that appears in the minutes.

3) Attendance at laboratory practices is mandatory, so non-attendance means suspending the subject. In the case of obtaining a grade lower than 5 in the practices, the grade can be recovered in the second opportunity exam (July). The grade of practices passed in previous courses will be saved.

4) 2nd CHANCE: The grades of the activities passed in the first opportunity will be saved for the second opportunity. For this second opportunity, the same requirements described in point 2 are established, being, in this case, the exam grade that limits the average with the rest of the activities. In addition, this call will have a specific test for the recovery of the practice grade if necessary.

GLOBAL ASSESSMENT:

The students who renounce the continuous evaluation may request global evaluation in the period established by the center. This evaluation will be carried out on the official dates of the first and second opportunity.

IN ORDER TO PASS THE SUBJECT, THE STUDENT MUST OBTAIN AN OVERALL GRADE EQUAL TO OR GREATER THAN 5.

5) The average will only be made with the grade of laboratory practices when the grade of the exam is equal to or greater than 4.25 points (calculated taking into account the overall grade of 85% for the exam and 15% for the grade of practices). A grade lower than 4.25 supposes suspending the subject and will be the grade that appears in the minutes.

6) Attending the laboratory practices is mandatory, so non-attendance will mean the suspension of the subject. In the case of obtaining a grade lower than 5 in the practices, the grade can be recovered in the official exam. The grade of practices passed in previous courses will be saved.

7) 2nd CHANCE: For this second chance, the same requirements described in point 5 are established.

The dates of the exams will be published on the website of the faculty

Sources of information

Basic Bibliography

R. Chang, **Química General**, 12ª Ed McGraw-Hill, Madrid 2017,

R. H. Petrucci, **Química General**, 11ª Ed Person Educación, S. A. Madrid 2017,

Kenneth W. Whitten et al, **Química**, 10ª Ed México D.F. : Cengage Learning 2015,

R. Chang, **Chemistry**, 7ª ed New York : McGraw Hill Education 2002,

Complementary Bibliography

3D structures of biological molecules, <http://www.biotopics.co.uk/JmolApplet/jcontentstable.html>,

Recommendations

IDENTIFYING DATA				
Bioloxía: Solo, medio acuático e clima				
Subject	Bioloxía: Solo, medio acuático e clima			
Code	V02G031V01106			
Study programme	Grao en Bioloxía			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán			
Department	Bioloxía vexetal e ciencias do solo Ecoloxía e bioloxía animal Física aplicada			
Coordinator	Soto González, Benedicto			
Lecturers	Fernández Covelo, Emma Martínez Piñeiro, Manuel Soto González, Benedicto Teira Gonzalez, Eva Maria			
E-mail	edbene@uvigo.es			
Web				
General description	O solo, xunto coa auga e o aire son os recursos máis importantes do medio natural xa que deles depende a vida sobre a terra. Estúdase a estrutura e a dinámica de cada un destes subsistemas terrestres, como son, como funcionan, así como a necesidade de comprender as súas interaccións complexas xa que son indispensables para un enfoque integral da calidade ambiental.			

Resultados de Formación e Aprendizaxe

Code	
A1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo.
A3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética.
B1	Desenvolver a aprendizaxe autónoma, identificando as súas propias necesidades formativas e organizando e planificando as tarefas e o tempo.
B2	Xestionar información científico-técnica de calidade utilizando fontes diversas. Analizar datos e documentos e interpretalos de forma crítica e rigorosa, incluíndo reflexións sobre a súa relevancia social e no ámbito profesional da Bioloxía.
B6	Desenvolver as capacidades de análises e sínteses, de razoamento crítico e argumentación, aplicándoas en contextos propios da Bioloxía e outras disciplinas científico-técnicas.
C7	Muestrear, caracterizar, catalogar e xestionar recursos naturais e biolóxicos (poboacións, comunidades e ecosistemas).
C8	Describir, avaliar e planificar o medio físico, usar bioindicadores e identificar problemas ambientais. Achegar solucións para o control, seguimento e restauración dos ecosistemas.
D3	Comprometerse coa sustentabilidade e medio ambiente. Uso de forma equitativa, responsable e eficiente dos recursos.
D5	Comunicar de maneira eficaz e adecuada, incluíndo o uso de ferramentas dixitais e o inglés.

Resultados previstos na materia

Expected results from this subject	Training and Learning Results			
Comprender as propiedades do medio físico que soporta a vida dun modo integrado.	A1	B2 B6	C8	D3
Adquirir os coñecementos básicos sobre o medio edáfico, acuático, atmosférico e o clima e a súa transcendencia na Bioloxía.	A1 A3	B1 B2 B6	C7 C8	D3 D5
Comprender os conceptos de cambio global e cambio climático.	A3	B2 B6	C8	D3
Aplicar coñecementos e técnicas propios da materia en diferentes procesos relacionados coa xestión de recursos naturais.	A1 A3	B2	C7 C8	D3 D5
Comprender a proxección social do medio físico e a súa repercusión no exercicio profesional.	A3	B2	C8	D3 D5
Coñecer e manexar os conceptos, terminoloxía e instrumentación científico-técnica relativos á materia.	A1 A3	B1 B2 B6	C7 C8	D3 D5

Contidos

Topic	
CLASES TEÓRICAS	CLASES TEÓRICAS
INTRODUCCIÓN	Tema 1. A Terra como sistema biofísico. Relacións entre os subsistemas terrestres.
SOLO	Tema 2. O solo como recurso medioambiental. Funcións do solo. Tema 3. Composición e organización do solo. Tema 4. Propiedades do solo. Tema 5. Edafoxénese: factores e procesos de formación. Tema 6. Tipoloxía de solos.
ATMOSFERA E CLIMA	Tema 7. A atmosfera: estrutura, composición e dinámica. Tema 8. Clima, Climatoloxía e Meteoroloxía. Tema 9. Elementos e factores do clima.
MEDIO ACUÁTICO	Tema 10. Ciclo da auga e recursos hídricos. Tema 11. Factores físico-químicos do medio acuático. Tema 12. Ambientes acuáticos: continentais e maríños.
MEDIO FÍSICO E CAMBIO GLOBAL	Tema 13. O solo como recurso non renovable. Degradación e conservación do solo. Tema 14. Cambio global e auga.
CLASES PRÁCTICAS	1. Descrición de solos no campo e métodos de mostraxe. 2. Caracterización de solos: composición e propiedades. 3. Balances hídricos. 4. Recollida de datos climáticos: caracterización e clasificación climática.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	60	90
Prácticas de laboratorio	16	24	40
Seminario	3	12	15
Resolución de problemas de forma autónoma	0	2	2
Exame de preguntas obxectivas	2	0	2
Observación sistemática	0	1	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Metodoloxía docente

	Description
Lección maxistral	Explicación dos conceptos fundamentais do temario co apoio de medios audiovisuais. Porase na plataforma Moovi toda a información da materia e o material didáctico utilizado durante as clases.
Prácticas de laboratorio	Estudo climático dunha zona e análise das características e propiedades dos solos. As prácticas son un complemento esencial das clases teóricas. Impartiranse no laboratorio e no campo e facilitarase un guion de cada unha delas. É obrigatoria a asistencia a todas as prácticas e a presentación dun informe/memoria.
Seminario	Casos prácticos relacionados co temario, resolución de exercicios etc... É obrigatoria a asistencia a todos os seminarios.
Resolución de problemas de forma autónoma	Exercicios de autoevaluación. Periodicamente poranse na plataforma MOOVI exercicios de autoevaluación co obxectivo de que o estudante evalúe os coñecementos adquiridos despois de estudar os temas.

Atención personalizada

Methodologies	Description
Lección maxistral	Orientación e resolución de dúbidas sobre as actividades propostas ao longo do curso e sobre os conceptos teóricos da materia.
Prácticas de laboratorio	Orientación e resolución de dúbidas sobre o traballo de prácticas a desenvolver polos alumnos
Seminario	Orientación e resolución de dúbidas sobre os informes a desenvolver polos alumnos

Avaliación

	Description	Qualification	Training and Learning Results			
Lección maxistral	Proba escrita (preguntas tipo test e/ou preguntas curtas) sobre os contidos fundamentais da materia	40	A1	B2	C7	C8
Prácticas de laboratorio	Cuestionario sobre as prácticas. Avaliación do informe/memoria das prácticas realizadas. Valorarase a estrutura do traballo, contido, resultados obtidos, análise dos datos e interpretación de resultados.	31	A3	B1 B2	C7 C8	D3 D5

Seminario	Avaliarase a participación activa e os informes presentados	21	A3	B2 B6	C7 C8	D5
Observación sistemática	Avaliarase a asistencia e participación activa durante as explicacións dos conceptos teóricos da materia	8		B1 B6		D5

Other comments on the Evaluation

Os contidos da materia abarcan aspectos básicos sobre tres elementos do medio físico (solo, media acuático e clima) e a súa relación coa Bioloxía.

Na avaliación continúa a ponderación da materia é a seguinte: Solo (60%), Medio Acuático (20%) e Clima (20%). Cada unha das actividades valorarase nunha escala de 1 ao 10 que logo será ponderada para obter a puntuación final. A materia considerarase aprobada sempre que a nota final ponderada sexa igual ou superior a 5 e se obtuvese na proba escrita polo menos un 5. Copiar nas probas escritas ou nos informes supón a obtención de cero puntos na proba na que se copiou. Para que un alumno sexa cualificado como " Non Presentado" non ten que ser avaliado en ningunha proba escrita ao longo do curso.

Na convocatoria de xullo o alumno só terá que recuperar os módulos suspensos (cualificación módulo < 5). Non haberá posibilidade de repetir os informes das prácticas e seminarios pero os alumnos suspensos poderán recuperar esa parte mediante unha proba específica no exame. Os criterios de valoración serán os mesmos que para a primeira convocatoria. Os alumnos repetidores que teñan aprobadas as prácticas e os seminarios, non terán que repetilos de novo, conservándose nese caso a cualificación do curso anterior.

No caso de que o alumno opte pola **avaliación global**, deberá solicitar este tipo de avaliación no prazo indicado polo centro. Neste caso, realizará un exame do contido de toda a materia, mantendo na ponderación os porcentaxes por módulos empregados na avaliación continúa. Para poder aprobar mediante este tipo de avaliación, o alumno deberá realizar obrigatoriamente as prácticas da materia.

Pódense consultar as datas dos exames no seguinte enlace: <http://bioloxia.uvigo.es/gl/docencia/exames>. Pódense consultar os horarios da materia no seguinte enlace: <http://bioloxia.uvigo.es/gl/docencia/horarios>

Bibliografía. Fontes de información

Basic Bibliography

BARRY RG & CHORLEY RJ, **Atmósfera, tempo y clima**, 7ª edición, Omega, 1999

DOBSON M & FRID C, **Ecology of Aquatic Systems**, 2th edition, Oxford University Press, 2009

ODUM EP, BARRET GW, **Fundamentos de Ecología**, 5ª edición, Thomson, 2006

PORTA J, LOPEZ ACEVEDO M, ROQUERO, C, **Edafología para la agricultura y el medio ambiente**, 3ª edición, Mundi-Prensa, 2003

PORTA J, LOPEZ ACEVEDO M, POCH RM, **Edafología: Uso y protección del suelo**, 3ª edición, Mundi-Prensa, 2014

RODRÍGUEZ, J, **Ecología**, 4ª edición, Pirámide, 2016

STRAHLER AN, STRAHLER AH, **Geografía física**, 3ª edición, Omega, 1989

SMITH TM, SMITH RL, **Ecología**, 6ª edición, Pearson, 2007

Weil RR & Brady NC, **The nature and properties of soils**, 15th edition, Pearson Education, 2017

Dorrnsoro C., **Curso: Introducción a la Edafología**, <http://www.edafologia.net/introeda/tema00/progr.htm>,

Ciclo hidrológico: págs 156-162; Ecosistemas marinos y de agua dulce: págs. 413-432,

<http://www.cengage.com/brookscole/>, Thomson, 2006

Complementary Bibliography

LAL R, **Encyclopedia of Soil Science**, Taylor & Francis, 2006

García Navarro A., **Curso: Edafología. Universidad de Extremadura**, <http://www.unex.es/edafo/>,

Recomendacións

Subjects that continue the syllabus

Análise e diagnóstico medioambiental/V02G030V01902

Biodiversidade: Xestión e conservación/V02G030V01905

Contaminación/V02G030V01906

Xestión e conservación de espazos/V02G030V01910

Subjects that it is recommended to have taken before

Física: Física dos procesos biolóxicos/V02G031V01102

Xeoloxía: Xeoloxía/V02G031V01103

Química: Química aplicada á bioloxía/V02G031V01105

IDENTIFYING DATA				
Statistics: Biostatistics				
Subject	Statistics: Biostatistics			
Code	V02G031V01107			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Sánchez Rodríguez, María Estela			
Lecturers	Sánchez Rodríguez, María Estela			
E-mail	esanchez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
A2	Students should know how to apply their knowledge to their work or vocation in a professional way. They also should have the competences that are usually proved through the elaboration and defence of arguments and the resolution of problems within their study field.
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.
A4	Students should be able to communicate information, ideas, issues and solutions to all audiences (specialist and unskilled audience).
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.
B4	Draft and write reports, documents and projects related to Biology. Proceed to their presentation and debate in the teaching and specialized areas, highlighting the competences of the degree.
B6	Develop analysis and synthesis, critical reasoning and argumentation skills, applying them in Biology and other scientific-technical disciplines.
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.
C12	Writing reports and technical dossiers, as well as directing and executing projects on topics related to biology and its applications.
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.
D5	Communicate effectively and appropriately, including the use of computer tools and English.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Present and interpret the main statistics of a data set.	A3	C1		
Study probability models		B2	C1	
Use random variables to model uncertainty.		B2	C1	
Identify the nature of the experimental variables for their subsequent analysis.	A4		C1	D4
Interpret hypothesis tests.	A2	B4	C12	
	A3	B6		
Use statistical techniques to perform biological analysis.	A2	B4	C1	D4
	A4	B6	C12	
Apply knowledge and technology related to statistics to design models of biological processes.	A3	B4	C1	D5
	A4	B6		
Obtain information, develop experiments and interpret the results.	A2	B2	C1	D4
	A3	B6	C12	D5
To understand the social projection of Biostatistics and its repercussion in the professional practice of the biologist.	A2		C12	D4
	A3			D5
	A4			
To know and handle the concepts, terminology and scientific-technical instrumentation related to statistical techniques.			C1	D4
			C12	

Contents	
Topic	
DATA EXPLORATORY ANALYSIS	Measures of central tendency, variability, skewness and kurtosis. Graphical representations. Biological variability. Linear and nonlinear transformations. Outliers and box plots. Mean and variance in subpopulations. Descriptive introduction to Anova.
PROBABILITY	Random experiments. Axiomatic definition of probability. Addition rule. Conditional probability. Total probabilities and Bayes' theorem. Independence of events. Assignment of probabilities. Applications: diagnostic test, relative risk and odds ratio.
MAIN DISTRIBUTIONS	Discrete and continuous random variables. Mean and variance. Main discrete and continuous distributions. Binomial and multinomial models. Other discrete models: hypergeometric, Poisson, negative binomial. Continuous models: Normal, log-normal, exponential, chi-square, t-student, F Fisher-Snedecor.
INTRODUCTION TO HYPOTHESIS TESTS. FREQUENCY TABLES: MEASURES AND TESTS	Introduction to hypothesis testing: type I error, type II error, significance level and p-value. Parametric and non-parametric statistical techniques. Tests for the mean and for the variance of a normal population. Confidence intervals. Frequency tables. Measures of association in frequency tables: nominal and ordinal variables. Prediction and concordance. Goodness-of-fit tests. Proportions, chi-square test. Independence and homogeneity tests. Normality test.
REGRESSION AND CORRELATION	Scatter plot. Least squares line. Correlation and determination coefficient. ANOVA and residual analysis. Other models: parabolic, exponential, potential. Introduction to multiple linear regression. Predictions.
INFERENCE TECHNIQUES TO COMPARE GROUPS	Comparisons between 2 groups. F test to compare variances. Student's t-test to compare means. Comparisons of more than 2 groups. ANOVA and multiple comparisons tests. Homogeneity of variances. Model hypothesis testing and alternative nonparametric techniques.
LABORATORY	EXCEL and open access software R: the Project for Statistical Computing

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	5	12	17
Laboratory practical	15	12.5	27.5
Autonomous problem solving	0	33.5	33.5
Lecturing	28	30	58
Essay questions exam	2	12	14

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Seminars	Activities focused on working on specific topics of the program.
Laboratory practical	Use of statistical software to complement the theoretical classes and seminars.
Autonomous problem solving	Work with problems of the different topics.
Lecturing	Exposition of the theory of the corresponding topics, illustrated with exercises.

Personalized assistance

Methodologies	Description
Autonomous problem solving	Any doubts that may arise at individual or group level will be answered. Students have a tutoring schedule.
Seminars	Any doubts that may arise at individual or group level will be answered. Students have a tutoring schedule.
Laboratory practical	Any doubts that may arise at individual or group level will be answered. Students have a tutoring schedule.

Assessment

Description	Qualification	Training and Learning Results
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Seminars	Written exam on seminar contents and topics 4, 5 and 6	30	A2 A3 A4	B2 B4 B6	C1	D4 D5
Laboratory practical	Exam with the R statistical programme analysing biological data	40	A2 A3 A4	B2 B4 B6	C12	D5
Essay questions exam	Exam with exercises and questions on topics 1, 2 and 3.	30	A2 A3	B2	C1	

Other comments on the Evaluation

Continuous assessment system (AC first opportunity): 3 tests will be carried out throughout the course, with a weighting of 30% (Test of essay questions in the month of February), 30% (Seminar Test) and 40% (Laboratory Test).

- AC qualification = 0.3 Developmental questions test + 0.3 Seminar test + 0.4 Laboratory test.

In the case of not achieving a minimum mark of 5 points, the student will have to take the Final Examination:

- AC qualification = 0.3 Final Exam + 0.3 Seminar test + 0.4 Laboratory test.

Continuous Assessment System (AC second opportunity):

- AC second opportunity qualification = 0.6 Final Exam + 0.2 Seminar Test + 0.2 Lab Test

Global assessment system (AG first and second opportunity):

- AG qualification = Final Exam

The calendar of final exams can be consulted at the following link: <http://bioloxia.uvigo.es/es/docencia/examenos>

Appointments for tutorials can be requested through the Online Secretariat or by filling in the form <https://esanchez.webs8.uvigo.es/contacto/>

Sources of information

Basic Bibliography

Mirás Calvo, M.A., Sánchez Rodríguez, E., **Técnicas estadísticas con hoja de cálculo y R. Azar y variabilidad en las ciencias naturales**, Servicio publicaciones Universidad de Vigo, 2018

Complementary Bibliography

Delgado de la Torre, R., **Probabilidad y estadística para ciencias e ingenierías**, Delta, 2008

Devore, Jay L, **Probability and statistics for engineering and sciences**, Brooks/Cole, 2010

Susan Milton, J., **Estadística para Biología y Ciencias de la Salud**, Tercera, McGraw-Hill, 2007

Recommendations

Other comments

The timetable of the classes can be consulted at the following link.

IDENTIFYING DATA				
Biology: Basic laboratory techniques				
Subject	Biology: Basic laboratory techniques			
Code	V02G031V01108			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Gil Martín, Emilio			
Lecturers	Barreal Modroño, M. Esther Combarro Combarro, María del Pilar Gallardo Medina, Mercedes Gallego Veigas, Pedro Pablo Gil Martín, Emilio González Orenge, Sara Lopez Patiño, Marcos Antonio Miguel Villegas, Encarnación de Míguez Miramontes, Jesús Manuel San Juan Serrano, María Fuencisla			
E-mail	egil@uvigo.es			
Web				
General description	Experimental subject designed to reach specific skills of handling, extraction and processing of biological samples, as well as their morphological, structural, functional and analytical characterization in the laboratory. The acquisition of these scientific and technical specific competences will be achieved through the assimilation of scientific and technical knowledge and the development of instrumental routines of general application in experimental biology. Furthermore, they will also provide the students with essential skills (transversal competences), which are pivotal for understanding specific topics of subjects in subsequent courses.			

Training and Learning Results				
Code				
A1	Students should prove understanding and knowledge in this study field that starts in the Secondary Education and with a level that, even though it is supported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.			
A5	Students should develop the necessary learning skills to undertake further studies with a high degree of autonomy.			
B1	Developing autonomous learning by identifying their own training need and organizing and planning tasks and time.			
B3	Apply the knowledge acquired in the degree and use the scientific-technical instrumentation and CIT in contexts of Biology and/or related to the professional practice.			
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.			
C3	Perform and interpret molecular, physicochemical and biological analyses, including samples of human origin. Conduct assays and functional tests under normal and abnormal conditions.			
C4	Isolate, identify and growth microorganisms, cells, tissues and organs, making easier their study and the assessment of their metabolic activity.			
C10	Identify biological and biotechnological processes and their potential applications, in particular in health, agri-food and environmental fields.			
D3	Commitment to sustainability and the environment. Equal, sensible and efficient use of resources.			
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.			
D5	Communicate effectively and appropriately, including the use of computer tools and English.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Understanding the basic techniques for the collection, cultivation and breeding of living beings.	A1	B3	C4	D3
Understanding the basic techniques for obtaining and processing biological samples.	A1	B3	C1	D3
		A5	C10	D4
To know and handle the basic techniques for observation, identification and analysis of biological samples.	A1	B3	C1	D4
	A5		C3	D5
			C10	

Applying knowledge of Basic Laboratory Techniques to isolate, identify, handle and analyze specimens and samples of biological origin, including virus, as well as to characterize their cellular and molecular constituents.	A1 A5	B1 B3	C1 C3 C10	D3 D4 D5
Analyzing the functioning of living beings and interpret vital parameters.	A1 A5	B1 B3	C1 C3 C10	D4
To know and handle the concepts, terminology and scientific-technical instrumentation related to Basic Laboratory Techniques.	A1	B3	C1 C3	D3 D4 D5

Contents

Topic

MODULE I. TECHNIQUES FOR THE PROCESSING AND OBSERVATION OF BIOLOGICAL SAMPLES	Unit 1. Fundamentals and types of optical microscopes and stereomicroscopy. Unit 2. Specimen fixation and inclusion. Unit 3. Fundamentals of microtomy. Types of microtomes and their handling. Unit 4. General staining techniques. Processing and observation of stained sections.
MODULE II. EXPERIMENTATION WITH MICROORGANISMS	Unit 1. Sterilization. Disinfection and asepsis. Unit 2. Elaboration of culture media. Unit 3. Culture of microorganisms and viruses. Unit 4. Biological risks.
MODULE III. EXPERIMENTATION WITH PLANTS IN THE LABORATORY	Unit 1. Germination. Unit 2. Plant cultivation. Unit 3. Analysis and interpretation of the results.
MODULE IV. EXPERIMENTATION WITH ANIMALS IN THE LABORATORY	Unit 1. Animals for research. Animal models and their basic characteristics. Unit 2. Legislation on experimentation with animals. Theoretical aspects about basic manipulation of living animals. Unit 3. Treatments administration and sampling in experimental animals.
MODULE V: PROCESSING AND ANALYTICAL TECHNIQUES OF BIOLOGICAL SAMPLES	Unit 1. Techniques for sample preparation. Unit 2. Techniques for sample separation I. Unit 3. Techniques for sample separation II. Unit 4. Techniques for sample analysis.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	16	32	48
Laboratory practical	38	52	90
Report of practices, practicum and external practices 0		1	1
Report of practices, practicum and external practices 0		1	1
Report of practices, practicum and external practices 0		1	1
Report of practices, practicum and external practices 0		1	1
Report of practices, practicum and external practices 0		1	1
Objective questions exam	2	5	7

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

Description

Lecturing	Teacher dissertation about the scientific concepts and technical guidelines needed for the acquisition of specific competences in manipulation, processing and analytical characterization of biological samples in the laboratory. The master sessions are complemented with individual and group activities to strengthen the more relevant learning objectives. Depending on the case, these activities may be carried out in the classroom or during the autonomous work time. All of them may be computed for evaluation.
Laboratory practical	Activities carried out in the laboratory. They involve the application to specific experimental goals of the knowledge and guidelines treated in the master sessions. In addition to the experimental work, laboratory practises include individual or group tasks aimed at promoting the acquisition of the specific and transversal competences of the subject. They can be performed either in the laboratory or as part of the student's autonomous work. Moreover, they will be computed for evaluation.

Personalized assistance

Methodologies	Description
Lecturing	The master sessions will be dynamical discussions open to the active participation of students, and incorporate test and other examination modalities to check the learning progress of each student and thus advise, if necessary, personalized reinforcement actions. It also contemplates the possibility of monitoring autonomous work or solving doubts arising by e-mail. On the other hand, it is established a reserve of 6 h/week/professor for tutoring and management of requests and/or learning problems they are encountering. The timetable of these tutorials will be announced by the responsible (coordinator) in the initial conference (Introductory activities) of the subject, and will be also available online, both in Moovi and the website of the Faculty.
Laboratory practical	Teachers will provide individualized attention to each student during laboratory practises, providing the support they need for a correct understanding of the experimental objectives, the methodology required or the specific techniques to be carried out. Once the experimental procedures have been completed, each student or work-group will be supervised and will receive ad hoc feedback based on the results obtained.

Assessment

Description		Qualification Training and Learning Results				
Report of practices, practicum and external practices	<p>CONTINUOUS ASSESSMENT</p> <p>MODULE I. The contents and skills acquired in the theoretical seminars and laboratory activities will be evaluated through the preparation of tests, which will be developed on the dates indicated in the four-month schedule. In addition, the systematic observation of students, their involvement, attitude and work quality will also be taken into account for evaluation.</p> <p>In case of not reaching a minimum score corresponding to 40%, the subject will be considered failed.</p> <p>The notes corresponding to the continuous evaluation will be made public by the staff within 15 days after the end of the teaching activity.</p>	15	A1 B1 C1 D3	A5 B3 C3 D4	C4 D5 C10	
Report of practices, practicum and external practices	<p>CONTINUOUS ASSESSMENT</p> <p>MODULE II. The contents and skills acquired in the theoretical seminars and laboratory activities will be evaluated through the preparation of tests, which will be developed on the dates indicated in the four-month schedule. In addition, the systematic observation of students, their involvement, attitude and work quality will also be taken into account for evaluation.</p> <p>In case of not reaching a minimum score corresponding to 40%, the subject will be considered failed.</p> <p>The notes corresponding to the continuous evaluation will be made public by the staff within 15 days after the end of the teaching activity.</p>	15				

Report of practices, practicum and external practices	<p>CONTINUOUS ASSESSMENT</p> <p>MODULE III. The contents and skills acquired in the theoretical seminars and laboratory activities will be evaluated through the preparation of tests, which will be developed on the dates indicated in the four-month schedule. In addition, the systematic observation of students, their involvement, attitude and work quality will also be taken into account for evaluation.</p> <p>In case of not reaching a minimum score corresponding to 40%, the subject will be considered failed.</p> <p>The notes corresponding to the continuous evaluation will be made public by the staff within 15 days after the end of the teaching activity.</p>	15	
Report of practices, practicum and external practices	<p>CONTINUOUS ASSESSMENT</p> <p>MODULE IV. The contents and skills acquired in the theoretical seminars and laboratory activities will be evaluated through the preparation of tests, which will be developed on the dates indicated in the four-month schedule. In addition, the systematic observation of students, their involvement, attitude and work quality will also be taken into account for evaluation.</p> <p>In case of not reaching a minimum score corresponding to 40%, the subject will be considered failed.</p> <p>The notes corresponding to the continuous evaluation will be made public by the staff within 15 days after the end of the teaching activity.</p>	5	
Report of practices, practicum and external practices	<p>CONTINUOUS ASSESSMENT</p> <p>MODULE V. The contents and skills acquired in the theoretical seminars and laboratory activities will be evaluated through the preparation of tests, which will be developed on the dates indicated in the four-month schedule. In addition, the systematic observation of students, their involvement, attitude and work quality will also be taken into account for evaluation.</p> <p>In case of not reaching a minimum score corresponding to 40%, the subject will be considered failed.</p> <p>The notes corresponding to the continuous evaluation will be made public by the staff within 15 days after the end of the teaching activity.</p>	20	
Objective questions exam	<p>FINAL INTEGRATING TEST (FIT)</p> <p>The fundamental contents and aptitudes of the subject will be evaluated in an obligatory, written examination. By means of several types of questions and exercises, the degree to which each student, relating and integrating the theoretical and applied knowledge acquired in the different modules, is able solving a real experimental case, will be evaluated.</p> <p>If FIT's score does not reach the 40% of maximum, the subject will be considered suspended.</p>	30	A1 B1 C1 D3 A5 B3 C3 D4 C4 D5 C10

Other comments on the Evaluation

CONTINUOUS EVALUATION

The academic calendar for the different modules and experimental groups, as well as the presentation of the subject by the coordinator can be consulted on the website of the Faculty (<http://bioloxia.uvigo.es/en/teaching/timetables>). The official dates for the FIT of the different calls can also be consulted on the this website (<http://bioloxia.uvigo.es/en/teaching/exams>).

The continuous assessment itinerary requires the student to carry out **ALL** the learning and evaluation activities established in each experimental module. If this requirement is not reached, the student will be governed by the global assessment system (see below).

Attendance at all classrooms is **MANDATORY to APPROVE THE SUBJECT**, unless justified absence by reasons officially established; illness or federated sport competitions.

The student suspended in TBL will receive as final score the lowest obtained in CE or FIT.

In order to be evaluated as "Not presented", it will be necessary to have no evidence of attendance to the classes nor to have performed CE and FIT tests.

The different modules that have been approved, will be kept for the academic year.

FINAL EVALUATION

Students who renounce the continuous evaluation by the officially established procedure will be evaluated by means of a **SINGLE THEORETICAL-PRACTICAL TEST**, to be carried out on the dates established in the official calendar.

Sources of information

Basic Bibliography

Bancroft, J.D. & Gamble, M., **Bancroft's theory and practice of histological techniques, 7th ed**, Churchill Livingstone-Elsevier Corp, 2013

Madigan, M.T., Bender, K.S., Buckley, D.H., Sattley, W.M., Stahl, D.A., **Brock Biology of microorganisms, 16th ed**, Pearson Corp, 2022

Taiz, L. & Zeiger, E., **Plant Physiology, 6ª ed**, Sinauer Associates, Inc., Publishers, 2015

Zúñiga, J., Tur J.A., Milocco, S.N. & Piñero R., **Ciencia y tecnología en protección y experimentación animal**, McGraw-Hill Interamericana, 2001

Hofmann, A. & Clokie, S., **PWilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, 8th Edition**, Cambridge University Press, 2018

Complementary Bibliography

MÓDULO I,

Kiernan, J.A., **Histological and Histochemical Methods: Theory and Practice, 4th ed**, Scion Publishing, 2008

MÓDULO II,

Capuccino, J.G., Sherman, N., **Microbiology. A laboratory manual, 12ª edición**, Benjamin/Cummings Company Inc., 2019

MÓDULO III,

Azcón-Bieto, J. & Talón, M., **Fundamentos de Fisiología Vegetal, 2ª ed**, McGraw-Hill Interamericana, 2008

MÓDULO IV,

Rodríguez Martínez J., Hernández Lorente MD. & Costa Ruiz J., **Introducción a la experimentación con animales**, Servicio de Publicaciones de la Universidad de Murcia, 2001

MÓDULO V,

Pingoud A., Urbanke C., Hoggett J. & Jeltsch A., **Biochemical methods**, Wiley-VCH, 2002

Recommendations

Subjects that continue the syllabus

Biochemistry I/V02G031V01201

Biochemistry II/V02G031V01206

Subjects that are recommended to be taken simultaneously

Biology: Basic field techniques/V02G031V01109

Statistics: Biostatistics/V02G031V01107

Subjects that it is recommended to have taken before

Physics: Physics of biological processes/V02G031V01102

Mathematics: Mathematics applied to Biology/V02G031V01104

Chemistry: Chemistry applied to biology/V02G031V01105

IDENTIFYING DATA				
Biología: Técnicas básicas de campo				
Subject	Biología: Técnicas básicas de campo			
Code	V02G031V01109			
Study programme	Grao en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán Galego			
Department	Biología vexetal e ciencias do solo Ecoloxía e bioloxía animal			
Coordinator	Serret Ituarte, Pablo			
Lecturers	Gomez Brandon, Maria Kim , Sin-Yeon Muñoz Sobrino, Castor Serret Ituarte, Pablo			
E-mail	pserret@uvigo.es			
Web				
General description	Aproximación metodológica aos estudos de campo en Biología.			

Resultados de Formación e Aprendizaxe	
Code	
A3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética.
A5	Que os estudantes desenvolven aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía.
B1	Desenvolver a aprendizaxe autónoma, identificando as súas propias necesidades formativas e organizando e planificando as tarefas e o tempo.
B6	Desenvolver as capacidades de análises e sínteses, de razoamento crítico e argumentación, aplicándoas en contextos propios da Biología e outras disciplinas científico-técnicas.
C1	Resolver problemas aplicando o método científico, os conceptos e a terminoloxía específica da Biología, os modelos matemáticos e as ferramentas estatísticas e informáticas.
C7	Muestrear, caracterizar, catalogar e xestionar recursos naturais e biolóxicos (poboacións, comunidades e ecosistemas).
D1	Comprender o significado e aplicación da perspectiva de xénero nos distintos ámbitos de coñecemento e na práctica profesional co obxectivo de alcanzar unha sociedade máis xusta e igualitaria.
D3	Comprometerse coa sustentabilidade e medio ambiente. Uso de forma equitativa, responsable e eficiente dos recursos.
D4	Colaborar e traballar en equipo ou en grupos multidisciplinares, fomentar a capacidade de negociación e de alcanzar acordos.
D5	Comunicar de maneira eficaz e adecuada, incluíndo o uso de ferramentas dixitais e o inglés.

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results
Recoñecer e describir o proceso de obtención de mostras no campo, desde o deseño da mostraxe até a recolección e conservación das mostras.	A3 B1 C1 D1 A5 C7 D3 D4 D5
Identificar, recoñecer e manexar a instrumentación aplicable a estudos de campo en estudos biolóxicos.	A3 C7 A5
Interpretar e inferir o significado de distintos parámetros biolóxicos relacionados coa estrutura e funcionamento de poboacións, comunidades e ecosistemas.	A3 B6 C1 D1 A5 D3 D4 D5
Interpretar os datos de certos parámetros ambientais utilizados como *descriptores de ecosistemas.	A3 B1 C1 D1 A5 B6 C7 D3 D4 D5

Contidos
Topic

Descrición do medio.	Solos. Intermareal rochoso. Hidromorfología de ríos.
Toma de mostrax no campo (deseño de mostraxes e métodos de extracción, recolección, transporte e conservación de mostrax).	Determinación do tamaño de mostra estatístico. Abundancia de animais e algas no intermareal. Mostraxe de artrópodos en vexetación. Vexetación ripícola. Biomasa de produtores primarios acuáticos. Biodiversidade e distribución de especies. Mostraxe de invertebrados en solos. Mostraxe de macroinvertebrados en augas doces.
Manexo de diferentes tipos de sensores e sondas de campo.	Sondas multiparamétricas para medir variables físicoquímicas en ríos (pH, O ₂ , Temperatura, conductividade). Correntímetros. Sensor PAR.
Manexo de guías, claves de identificación e material cartográfico.	Macroalgas. Invertebrados intermareales. Invertebrados terrestres. Vexetación ripícola.
Estudos de demografía (observación, identificación, marcaxe e censos).	Tamaño poboacional de macroalgas.
Aplicación de biometría (medidas de lonxitude, perímetros, etc.).	Realizaranse medicións en distintas prácticas.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	6	3	9
Seminario	2	0	2
Prácticas de campo	45	22	67
Informe de prácticas, prácticum e prácticas externas	0	48	48
Exame de preguntas obxectivas	2	16	18
Resolución de problemas e/ou exercicios	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Explicación de conceptos fundamentais de Botánica, Ecoloxía e Zooloxía e planificación do traballo de campo. Método científico e mostraxe en Botánica, Ecoloxía e Zooloxía.
Seminario	Cálculos, dúbidas e normas de redacción de informes.
Prácticas de campo	Saída aos distintos ecosistemas, observación e caracterización de comunidades, determinación de biomasa de distintos compartimentos tróficos, recolección de mostrax e datos relativos aos organismos vivos e medio físico analizados.

Atención personalizada	
Methodologies	Description
Prácticas de campo	O alumno recibirá atención personalizada para calquera dúbida relativa ao cálculo de resultados e análises de datos.
Tests	Description
Informe de prácticas, prácticum e prácticas externas	O alumnado recibirá atención personalizada para calquera dúbida xurdida na realización da memoria de prácticas
Exame de preguntas obxectivas	O alumno recibirá atención personalizada para calquera dúbida xurdida na preparación do exame.

Avaliación			
	Description	Qualification	Training and Learning Results
Lección maxistral	Avaliarase como parte do exame	5	B6 C1 D3 D5
Prácticas de campo	Valorarase a dedicación, esforzo e rigor no traballo realizado durante as saídas de campo e nas prácticas de laboratorio.	5 A3	C1 D1 C7 D3 D4

Informe de prácticas, prácticum e prácticas externas	Avaliarase mediante memorias que introduzan, presenten, analicen e discutan os resultados obtidos durante o traballo de campo.	40	A3 A5	C1 C7	D1 D3 D4 D5
Exame de preguntas obxectivas	Avaliaranse os coñecementos adquiridos mediante un exame de preguntas curtas e resolución de casos.	40	A3 A5	B1 B6	C1 D5
Resolución de problemas e/ou exercicios	Avaliarase a resolución de exercicios baseados nos resultados obtidos no campo e laboratorio.	10	A3 A5	B1 C1	D4 D5

Other comments on the Evaluation

Os horarios da materia e calendarios de exames poden ser consultados na páxina web da Facultade: <http://bioloxia.uvigo.es/é/docencia/horarios> e <http://bioloxia.uvigo.es/gl/docencia/exames>.

AVALIACIÓN CONTINUA

A avaliación é continua ao longo do curso. Para poder ser avaliado de forma continua, o alumnado deberá realizar todas as actividades planificadas.

As prácticas de laboratorio son complementarias ás de campo, e avaliaranse conxuntamente con estas.

Para poder concurrir as probas de avaliación continua é obrigatoria a participación en polo menos o 80 % das prácticas.

Si un alumno copia na proba teórica e/ou nos informes suspenderá automaticamente dita proba nesa convocatoria.

2ª OPORTUNIDAD

O alumnado que non superase o exame ou a avaliación de memorias o problemas en primeira convocatoria poderá ser examinado na parte suspensa na segunda convocatoria. Si non se supera a materia o matricularse de novo no seguinte curso, implicará repetir todas as actividades avaliáveis.

AVALIACIÓN GLOBAL

Os estudantes que renuncien a avaliación continua, poderán solicitar avaliación global no período establecido polo centro. Dicha avaliación levarase a cabo nas datas oficiais de primeira e segunda oportunidade.

Para poder concurrir as probas de avaliación global é obrigatoria a participación en polo menos o 80 % das prácticas.

As probas de avaliación global consistirán na entrega de informes de prácticas que introduzan, presenten, analicen e discutan os resultados obtidos durante o traballo de campo (50%) e de un examen de preguntas obxectivas (50%).

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

Barrientos, J.A., **Curso práctico de entomología**, 1984
 Bennet, D.P. & Humphries, D.A., **Introducción a la ecología de campo**, 1978
 Campbell, A.C., **Guía de campo de la flora y fauna de las costas de España**, 1979
 Castro, M. e outros, **Guía micológica dos ecosistemas galegos**, 2005
 Castro, M. e outros, **Guía das árbores autóctonas e ornamentais de Galicia**, 2007
 Chinery, M., **Guía de los insectos de Europa**, 2007
 Díaz González, T.E e outros, **Curso de Botánica**, 2004
 Font Quer, P., **Diccionario de Botánica**, 2009
 García, X.R., **Guía das plantas de Galicia**, 2008
 Otero, J. e outros, **Guía das macroalgas de Galicia**, 2002
 Pérez Valcárcel, C e outros, **Guía dos líques de Galicia**, 2003
 Samo Lumbreras, A.J. e outros, **Introducción práctica a la Ecología**, 2008
 Sanson, G., **Atlante per il riconoscimento del macroinvertebrati dei cori d'acqua italiani**, 1992
 Southwood, T.R.E. & Henderson, P., **Ecological methods**, 2000
 Sutherland, W.J., **Ecological Census Techniques: A handbook**, 2006

Recomendacións

Subjects that continue the syllabus

Botánica I: Algas e fungos/V02G031V01202
 Botánica II: Arquegoniadas/V02G031V01207
 Zooloxía I: Invertebrados non artrópodos/V02G031V01205

Subjects that are recommended to be taken simultaneously

Biología: Ferramentas informáticas en biología/V02G031V01110

Biología: Solo, medio acuático e clima/V02G031V01106

Biología: Técnicas básicas de laboratorio/V02G031V01108

Other comments

1. Para un mellor desenvolvemento da materia, aconséllase LER CON ATENCIÓN a Guía Docente (metodoloxía e avaliación), así como as informacións presentadas en MOOVI de forma continua polo profesorado e/ou coordinador.

2. O material didáctico publicado en MOOVI, facilitará a comprensión das explicacións, mellorará a resolución de cuestións e dúbidas e permitirá rendibilizar o tempo das clases maxistras, seminarios, prácticas e tutorías, polo que debe ser lido polo alumno previamente á realización das prácticas. Non preparar antes a práctica, implica que non contabilice a asistencia á mesma e a inasistencia ao 80 % das actividades implica non poder presentarse á materia nese ano académico.

3. No laboratorio é INDISPENSABLE o uso de bata e nas saídas ao campo, o calzado e a roupa serán ADECUADAS ás características da zona visitada e á climatoloxía do momento. O incumprimento destas normas implica non poder realizar a práctica correspondente e a inasistencia ao 80 % das actividades implica non poder presentarse á materia nese ano académico.

4. En prácticas de campo rexen as mesmas normas de comportamento que na aula e/ou no laboratorio.

IDENTIFYING DATA				
Biology: Informatic tools in biology				
Subject	Biology: Informatic tools in biology			
Code	V02G031V01110			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Carvajal Rodríguez, Antonio			
Lecturers	Carvajal Rodríguez, Antonio Torres Palenzuela, Jesús Manuel Varela González, Sara			
E-mail	acraaj@uvigo.es			
Web				
General description	The aim of the subject is to enter to the student in the importance of the computational appearance in the modern Biology showing him a map of applications in the diverse fields of the same. The student will see and will practise examples that go from the use of teledetection, the systems of geographic information and mapping of territories, digital treatment of the image, the importance of the biological databases, etc. The student also will purchase notions on computer programming given his to current importance for the exert of the biologist to professional level and scientist.			

Training and Learning Results

Code	
A1	Students should prove understanding and knowledge in this study field that starts in the Secondary Education and with a level that, even though it is supported in advanced books, also includes some aspects that involve knowledge from the vanguard of the study field.
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.
A5	Students should develop the necessary learning skills to undertake further studies with a high degree of autonomy.
B1	Developing autonomous learning by identifying their own training need and organizing and planning tasks and time.
B4	Draft and write reports, documents and projects related to Biology. Proceed to their presentation and debate in the teaching and specialized areas, highlighting the competences of the degree.
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.
D1	Understand the meaning and use of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a fairer and more equal society.
D2	Communicate speaking and in writing in Galician.
D3	Commitment to sustainability and the environment. Equal, sensible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Know handle tools of research of information in Biology.	A1 A3 A5	B4	C1	D1 D2 D3
Know handle databases and extract useful information.	A1 A3 A5	B4		D1 D2 D3
Know technicians of teledetection and analysis of image and his application for the study of ecosystems.	A1 A3 A5	B1 B4	C1	
Know basic technicians of systems of geographic information (GIS). Cartography, use of information georeferenced, vectorial analysis, environmental maps.	A1 A3 A5	B4	C1	
Know employ technicians of basic programming in Biology.	A1 A3 A5	B1 B4	C1	
Know tools for the analysis of data in Biology.	A1 A3 A5	B1 B4	C1	D1 D2 D3

Contents

Topic

Research of information in Biology.	Concept of database. Main biological databases. Applications of databases in biology. Creation and management of databases.
Technicians and physical principles of the teledetection.	Teledetection, spectrum EM, processes of interaction with the matter. Resolutions, orbits and sources of data of teledetection. Spectral behaviour of the covers, measurable parameters and indexes of interest in biology.
Visual and digital treatment of image.	Corrections, Improvements and Transformations
Systems of geographic information (*GIS).	Systems of Geographic Information, Systems of Coordinates and Projections. Conservation and management of the territory. GIS In R, vectorial formats and raster, operations with layers GIS.
Notions of programming.	The computer as a working tool in biology. Biology and the programming. What is to program? What is a programming language? Reasons for programming in Biology? Introduction to programming.
Free software for the programming and the treatment of data in Biology.	Tools for an open science

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	3	6	9
Lecturing	3	6	9
Lecturing	4	8	12
Practices through ICT	16	5	21
Practices through ICT	12	5	17
Practices through ICT	12	5	17
Problem solving	0	65	65

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Classes are organised in 50-minute sessions. In most cases they will be devoted to explaining basic concepts and methods. Due to time constraints, students will be asked to do autonomous work.
Lecturing	
Lecturing	
Practices through ICT	The aim of the practical sessions on the computer is to show some of the most important computational applications in Biology, as well as to introduce the student to basic aspects of database management and programming applied to Biology.
Practices through ICT	
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Problem solving	Problem solving and exercises complement and reinforce what has been seen in theoretical and practical classes. In the learning of the different uses of computer tools for Biology, problem solving is a very important pedagogical resource.

Personalized assistance

Methodologies Description

Problem solving	The student's learning process, which complements the lectures and practicals, will be carried out through the development of non face-to-face activities and through the Moovi distance learning platform. On this platform the student will find some of the following resources: the material with the presentations of the theory classes, complementary readings, useful documents to study and complete the theory classes, the practice scripts, lists of problems and exercises to be completed in a given period of time, and self-assessment exams. The lecturers will set aside time to attend to and resolve students' doubts, both for the lectures and for the practical classes. In these activities, the teacher's function is to orient and guide the students' learning process and help them to successfully complete the corresponding autonomous work. On the first days of class, the teaching staff indicate the procedure for carrying out this personalised attention.
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Assessment

	Description	Qualification	Training and Learning Results
Lecturing	- Final examination block 1 (TD) - Attendance to the face-to-face activities	14 A1 A3 A5	C1
Lecturing	- Final examination block 2 (R) - Attendance to the face-to-face activities	13 A1 A3 A5	C1

Lecturing	- Final examination block 3 (Python) - Attendance to the face-to-face activities	13	A1 A3 A5		C1
Practices through ICT* Teledetection (TD):	- Attendance and achievement - Final Examination - Report -Resolution of problems/exercises	20	A1 A3 A5	B4	C1
Practices through ICT* R:	- Attendance and achievement - Final Examination - Report -Resolution of problems/exercises	20	A1 A3 A5	B4	C1
Practices through ICT* Python:	- Attendance and achievement - Final Examination - Report -Resolution of problems/exercises	20	A1 A3 A5	B4	C1

Other comments on the Evaluation

The subject consists of three differentiated thematic blocks, which constitute per se important tools for the performance of modern Biology:

Thematic block-1: Remote sensing and geographic information systems (TD)

Thematic block-2: Data analysis and R programming language

Thematic block-3: Introduction to programming with Python

CONTINUOUS ASSESSMENT

It is the default evaluation mode. The detailed evaluation is:

Master lesson:

Face-to-face exam block 1: 14%

Face-to-face exam block 2: 13%

Face-to-face exam block 3: 13%

Assistance to face-to-face activities

ICT-supported practices:

Block 1: 20%

Block 2: 20%

Block 3: 20%

Attendance and use

Memory

Problem solving and exercises

Presentation of exercises on the virtual platform within the established period

Control at the end of each practice

Final exam

To pass the subject it is necessary

1) Obtain a minimum final grade of 4 out of 10 (40%) in each block, both in its practical part and in the final exam. If the minimum of each block is not exceeded, the subject will not be approved.

2) Attendance at all face-to-face activities (including practices) is MANDATORY to PASS the subject, except duly justified absence for any of the officially considered reasons for exemption (illness or federated sports commitments).

3) In the practical part, the student must take a test at the end of each practice of each group. Passing this test (or completing a project if the teacher so decides because the student has not passed the practical part) will be necessary to pass the subject in addition to the final exam. The practical part (attendance to practices plus passing the test or work if applicable) will account for 20% of the total final mark in each block.

4) The final exam is broken down into three independent tests, one per block, and each block accounts for 13% (14% in block 1) of the final grade, and it is necessary to obtain a minimum of 5 points out of 10 in said exam.

5) If, and only if, the minimum grade for each block has been exceeded, the final grade for the subject is calculated as the weighted average of the grades for each block according to the formula:

FIB final mark = block 1 (0.2 practical note + 0.14 exam) + block 2 (0.2 practical note + 0.13 exam) + block 3 (0.2 practical note + 0.13 exam).

If the minimum grade is not reached in any block, the final grade is failed.

That is to say, the minimum mark of each block must be reached to calculate the final mark in the indicated way. Note that the delivery of the memory, work and / or practical exercises required by the teacher in each block is mandatory so that the non-presentation of it prevents passing the subject (the minimum grade per block will not be reached).

Students who do not take the final exam will be recorded as Not Present.

Second opportunity

All grades, except for the final exam, will be saved for the second chance in July. Therefore, if a student has not completed the practical part (does not reach the minimum grade) they will not be able to pass the second chance exam. In the case of the final exam, if a student has passed a block, it is at the discretion of the teacher to save the note for the second opportunity. In any case, the student can always present himself to raise the grade.

GLOBAL EVALUATION

The request for this evaluation option must be submitted at the time and in the manner determined by the Center, which will be published prior to the academic start.

Given the experimental nature of all the activities, attendance at them is mandatory to be eligible for this evaluation option.

Failure to attend practices, compulsory classes and seminars, without justified cause, invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

In the case of the global exam, if the student has attended all the activities. The overall test is divided into two parts for each thematic block: a practical part (60% of the mark) and a theoretical part (40%) of the mark.

OTHER CONSIDERATIONS

Any attempt to carry out illegal activities in the exams (copying, etc.), as well as plagiarism in the activities carried out will result in a failing in the matter.

TEACHING TIMETABLE: <http://bioloxia.uvigo.es/es/docencia/horarios>

EXAM TIMETABLE: <http://bioloxia.uvigo.es/es/docencia/examenes>

TIPS TO FACILITATE THE SUBJECT

1) For a better development of the subject, it is advisable to CAREFULLY READ the Teaching Guide (methodology and evaluation), as well as the information presented on the Moovi platform continuously by the teaching staff and/or coordinator.

2) The didactic material published on the Moovi platform will facilitate the understanding of the explanations, will improve the resolution of questions and doubts and will make it possible to make profitable the time of the master classes, practices and tutorials, so it must be read by the student.

Sources of information

Basic Bibliography

Emilio Chuvieco, **Teledetección ambiental : la observación de la Tierra desde el espacio**, 2010

Hoboken, NJ, **QGIS and generic tools**, John Wiley and Sons, Inc, 2018

David Roldán Martínez, **Bioinformática. El ADN A Un Solo Clic**, 2015

Haddock S.H.D, **Practical Computing for Biologists**, Ed. Sinauer Associates, 2011

Hadley Wickham and Jenny Bryan, **R-packages**, O Reilly, 2015

Complementary Bibliography

Hadley Wickham, **Advanced R**, O Reilly, 2019

Dr. Martin Jones, **Python for Biologists: A complete programming course for beginners**, 2013

Paruelo, J.M, **La caracterización funcional de ecosistemas mediante sensores remotos**, Ecosistemas 17(3):4-22, 2008

Kerr, J., Ostrovsky, M, **From space to species: ecological applications for remote sensing**, Trends in Ecology and Evolution 18:299-305, 2003

Rodríguez-Sánchez, F., Pérez-Luque, A.J. Bartomeus, I., Varela, S, **Ciencia reproducible: qué, por qué, cómo.**, Ecosistemas 25(2): 83-92. Doi.: 10.7818/ECOS.2016., 2016

Carey MA, Papin JA., **Ten simple rules for biologists learning to program**, Computational Biology 14:e1005871, 2018

Himelblau E., **A cartoon guide to bioinformatics by a novice coder.**, Nature [Internet]. Available from: <https://www.nat>, 2021

Recommendations

Subjects that are recommended to be taken simultaneously

Statistics: Biostatistics/V02G031V01107

Subjects that it is recommended to have taken before

Biology: Evolution/V02G031V01101

Physics: Physics of biological processes/V02G031V01102

Geology: Geology/V02G031V01103

Mathematics: Mathematics applied to Biology/V02G031V01104
