



IDENTIFYING DATA

Pollution

Subject	Pollution			
Code	V02G031V01402			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Beiras García-Sabell, Ricardo Fernández Covelo, Emma			
Lecturers	Combarro Combarro, María del Pilar Fernández Covelo, Emma González Rodríguez, Luis Mariño Callejo, María Fuencisla			
E-mail	emmaf@uvigo.es rbeiras@uvigo.gal			
Web				
General description	Know of form updated the distinct sources and types of contaminants that affect to the half and to the biota Know the dynamics of the *contaminantes in the compartments of the ecosystem Know the processes of reuse of waste and biorremediación for recovery of environments contaminated http://bioloxia.uvigo.es/docs/docencia/horarios/hor_4grado_1sem1718.pdf			

Training and Learning Results

Code	
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.
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.
B5	Develop capacities for creativity, innovation and entrepreneurship, in academic and social relevant fields as well as in interaction with the productive sector.
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.
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.
C10	Identify biological and biotechnological processes and their potential applications, in particular in health, agri-food and environmental fields.
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		
To know the main sources, the different types and, above all, the dynamics of the most important pollutants and their relationship with biology.	A3	C1 C10	D3

To understand the concept of environmental pollution and its effects on organisms. To understand the processes of treatment and bioremediation of pollution.	A3	B2	C1 C8 C10	D3
To be aware of the different types of waste, their treatment and their use in recovery processes in degraded environments.	A3	B2 B5	C1 C8 C10	D3
To get an introductory overview of environmental toxicology, agro-food and toxicology in living beings.	A3	B2	C1 C8	D3
To know and understand the situations in which the legislation and the regulations must be applied.	A3	B2 B4 B5	C12	D3
Applying knowledge and techniques related to contamination in different processes related to environmental management.	A3	B2 B5	C1 C7	D3
Applying knowledge and technology related to Contamination in aspects related to the production, exploitation, analysis and diagnosis of biological processes and resources.	A3	B2	C1 C8 C10	D3
To obtain information, develop experiments and interpret results.	A3	B4 B5	C7 C12	D4 D5
To understand the social projection of pollution and its repercussions on professional practice.	A3	B5	C1 C8	D3
To know and use the concepts, terminology and scientific-technical instrumentation related to Contamination.	A3	B2 B5	C8	D3

Contents

Topic

1. INTRODUCCION To THE CONTAMINATION	- Definition. Basic concepts. Types and categories of contaminants. - Sources and roads of entrance to the environment and biota. - Dynamic of contaminants: distribution and flow. - Bioindicators, biomonitors. - Legislation and normative
2. BIODEGRADABLE WASTE	-Organic matter -Oil and derivative
3. ORGANIC POLLUTANTS	-PAHs, Hydrocarbons halogenados, PCBs
4. SOLID WASTE AND DISSIPATE	- Plastic and other solid waste - heat
4. INORGANIC POLLUTANTS	-Acidity -Elements potentially toxic
5. MICROBIAL POLLUTION	-Concept and sources of pollution of microbial origin -Microorganisms indicators of pollution -Dynamic of microbial pollution in atmosphere, floor and water -residual Waters and treatment. Treatment anoxic of lick. -Impact of the pollution in environment. -Legislation and normative on microbiological pollution
6. TREATMENT OF WASTE And PROCESSES OF RECOVERY	- Biorremediation. - Composting. - Reuse of waste through the system am used to-plant - Recovery of floors contaminated
7. BIOLOGICAL EFFECTS OF The CONTAMINANTS	-Exhibition of alive organisms the contaminants. Routes of entrance. Toxicocinética. Bioaccumulation, Biotransformation. -Effects of the contaminants to physiological level. -Molecular and cellular mechanisms of action of the contaminants. -Essays of toxicity. -Effects of the contaminants to populational level and of communities of organisms. -Evolution of resistance.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	20	10	30
Seminars	8	8	16
Mentored work	1	63	64
Lecturing	20	10	30
Objective questions exam	2	2	4
Report of practices, practicum and external practices	1	2	3
Problem and/or exercise solving	1	2	3

*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	Effect of a contaminant in the soil: it will study the total content and the availability. Effects on germination, growth and other physiological parameters of plants. Effect in the reproduction of oligoquetos and integrity of the lysosomal membrane and microbiological analysis of the solution of the floor. Detection of microbiological indicators of pollution. The assistance to practices will be compulsory to be able to surpass the matter
Seminars	It will supplement the theoretical part boarding aspects that in the remained clear what was necessary to supplement. Resolution of doubts, etc. The assistance to seminars is obligatory for power surpass the subject
Mentored work	The students will have the help of the professors of the matter for the preparation of the work of practices
Lecturing	Theoretical development-practical, presentation of objectives and conceptual frame of each subject, presenting specific bibliography and examples related. At the end of the explanation of each subject (subjects 1, 2, 3, 4, 5, part of the 6 and 7), will deliver to the students a questionnaire of questions referred to the even and that will owe to deliver in the term that was fixed opportunely. In the part of Microbioloxía (subject 5 and part of the 6), the students will cover a test in the classroom when finishing the explanation of each of the of the subjects.

Personalized assistance	
Methodologies	Description
Lecturing	During all the process of learning and especially in hours of tutoring, will attend all the doubts exposed in relation with the contained theoretical of the subject
Laboratory practical	During all the process of learning and also in schedule of totoring will attend all the doubts exposed in relation with the contained practical of the subject
Seminars	During the development of this activity will attend all the doubts exposed poles students

Assessment				
	Description	Qualification	Training and Learning Results	
Objective questions exam	Final control of the matter by means of a questionnaire of short answers and/or test. The evaluation of this control will suppose 30% of the total qualification of the matter. It is precise to reach a 5 to do average with the practical note.	30	A3 B5	B2 C10 D3
Report of practices, practicum and external practices	The integrated report of the practices of edaphology, zoology, vegetal physiology and microbiology will be realised in the format of scientific article according to the norms of the Environmental Pollution. At the beginning of course and in each one of the practices of the matter will realise indications of the requirements of them. It will be necessary to approve this part to surpass the matter	40	A3 B4 C12	B2 C1 D4 D5
Problem and/or exercise solving	Evaluation of the participation of the student in the seminars, assistance to theoretical kinds, etc. (10%) The another 20% corresponds the questionnaires or test of each subject	30	A3 B5	B2 C8 D3 C10 D4

Other comments on the Evaluation

For the July call, the approved parts are retained, as it is assumed that the skills, abilities and knowledge acquired are not lost.

It is necessary to achieve a 5 in each of the parts of the subject (short answer tests, practice report and problem solving) in order to pass the subject. In the event that this is not fulfilled in any of the parts, the final grade of the subject will be the average up to a maximum of 4.9

http://bioloxia.uvigo.es/eres/docencia/*examenes

GLOBALASSESSMENT

Students who waive continuous assessment may request a global assessment within the period established by the centre. This evaluation will be carried out on the official dates of first and second chance. This evaluation will allow you to achieve 100% of the score of the subject in an exam broken down into two parts:

Theoretical content (65%) Practical content (35%).

Sources of information

Basic Bibliography

Complementary Bibliography

- Capó Martí, M., **Principios de Ecotoxicología**, Tébar,
- Mason, C.F., **Biology of Freshwater Pollution**, Longman, 3^a ed.,
- Clark, R.B., **Marine Pollution**, Oxford University, 5^a ed.,
- Walker, C.H., Hopkin, S.P., Sibly, R.M., Peakall, D.B., **Principles of Toxicology**, Taylor & Francis, 3^a ed.,
- Seoáñez Calvo, M., **Tratado de la Contaminación atmosférica**, Mundi Prensa,
- Lipps, W.C., Braun-Howland, E.B., Baxter, T.E., **Standard Methods for the Examination of Water and Wastewater. 34 ed.**, A.P.H.A., A.W.W.A. & W.E.F., 2022
- Lagadic, L., Caquet, T., Amiard, J-C, Ramade, F., **Use of biomarkers for Environmental Quality Assessment**, Balkema,
- DeCaprio, A.P. (ed.), **Toxicologic Biomarkers**, Ed. Taylor & Francis,
- Mirshal, I., **Soil Pollution: Origin, Monitoring & Remediation.**, Springer Verlag,
- Sparks, D.L., **Environmental Soil Chemistry**, Academic Press,
- Tan, K., **Environmental Soil Science**, Marcel Dekker. New York,
- McCutcheon S.C. , Schnoor J.L., **Phytoremediation: Transformation and Control of Contaminants.**, Wiley and Sons, Inc.,
- Singh, A., Ward, O.P., **Applied Bioremediation and Phytoremediation.**, Springer-Verlag,
- Benlloch, M., Sancho, E., Tena, M. (eds.), **Fitorremediación de suelos contaminados del área de Aznalcóllar**, Universidad de Córdoba,
- Schmidt, T.M., Schaechter, M., **Topics in Ecological and Environmental Microbiology**, Academic Press,
- Bertrand, J.C., P. Caumette, P. Lebaron, R. Matheron, P. Normand, T. Sime-Ngando, **Environmental Microbiology: Fundamentals and Applications: Microbial Ecology.**, Springer.,
- Pepper, I.L., C.P. Gerba, T.J. Gentry., **Environmental Microbiology. 3^o ed.**, Academic Press,
- H.B. Bradl, **Heavy Metals in the Environment: Origin, Interaction and Remediation**, Elsevier,
- Alina Kabata Pendias, **Trace Elements in Soils and Plants**, CRC Press,
- Yates, M.V., J.M., C.H. Nakatu, R.V. Miller., **Manual of Environmental Microbiology. 4^a ed.**, ASM Press.,
- Barton, L.L., McLean, R.JC., **Environmental Microbiology and Microbial Ecology.**, Wiley-Blackwel,
- Beiras, R., **Marine Pollution: sources, fate and effects of pollutants in coastal ecosystems.**, Ed. Elsevier. UK., 2018
- Lipp, W.C., E. B. Braun-Howland, T.E. Baxter (eds.), **tandard Methods for the Examination of Water and Wastewater.24 th.**, A.P.H.A., A.W.W.A. and W.E.F. Washington., 2023

Recommendations

Subjects that continue the syllabus

Environmental analysis and diagnosis/V02G031V01413

Subjects that it is recommended to have taken before

Biology: Soil, aquatic environment and climate/V02G031V01106