Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1102004 **Name:** Bioindicators

Credits: 6,00 **ECTS Year:** 0, 3, 4 **Semester:** 1

Module: Elective Courses

Subject Matter: Bioindicadores **Type:** Elective

Department: Biotechnology

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

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Module organization

Elective Courses

Subject Matter	ECTS	Subject	ECTS	Year/semester
Marine Biotechnology	6,00	Marine Biotechnology	6,00	0, 3, 4/1
Pharmacology and Toxicology	6,00	Pharmacology and Toxicology	6,00	0, 3/1
R&D in Marine Sciences	6,00	R&D in Marine Sciences	6,00	3, 4/1
Sea Food Technology	6,00	Sea Food Technology	6,00	3, 4/1
Instrumental Techniques of Marine Analysis	6,00	Instrumental Techniques of Marine Analysis	6,00	This elective is not offered in the academic year 24/25
Genetic Techniques Applied to the Marine Environment	6,00	Genetic Techniques Applied to the Marine Environment	6,00	This elective is not offered in the academic year 24/25
Principles of Food Biotechnology	6,00	Food Biotechnology	6,00	0, 3, 4/1
Plant Tissue and Cell Culture	6,00	Plant Tissue and Cell Culture	6,00	This elective is not offered in the academic year 24/25
Molecular Phytopathology	6,00	Molecular Phytopathology	6,00	3, 4/1
Agricultural Plant Breeding	6,00	Agricultural Plant Breeding	6,00	0/1
Seed Physiology and Molecular Biology	6,00	Seed Physiology and Molecular Biology	6,00	This elective is not offered in the academic year 24/25

Biocontrol for Crop Protection	6,00	Biocontrol for Crop Protection	6,00	This elective is not offered in the academic year 24/25
Agrigenomics	6,00	Agrigenomics	6,00	This elective is not offered in the academic year 24/25
Food Microbiology and Toxicology	6,00	Food Microbiology and Toxicology	6,00	0/1
Biomolecular Modeling	6,00	Biomolecular Modeling	6,00	0/1
Pharmaceutical Engineering and Drug Design	6,00	Pharmaceutical Engineering and Drug Design	6,00	0, 4/1
Gene Therapy	6,00	Gene Therapy	6,00	0, 4/1
Molecular Pathology	6,00	Molecular Pathology	6,00	0, 4/1
Clinical Biotechnology	6,00	Clinical Biotechnology	6,00	0/1
Immunology	6,00	Immunology	6,00	0, 3/1
Principles of Environmental Biotechnology	6,00	Environmental Biotechnology	6,00	This elective is not offered in the academic year 24/25
Biosensors	6,00	Biosensors	6,00	This elective is not offered in the academic year 24/25
Environmental Engineering	6,00	Environmental Engineering	6,00	This elective is not offered in the academic year 24/25

Bioremediation	6,00	Bioremediation	6,00	This elective is not offered in the academic year 24/25
Environmental Toxicology	6,00	Environmental Toxicology	6,00	This elective is not offered in the academic year 24/25
Bioindicadores	6,00	Bioindicators	6,00	0, 3, 4/1

Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

R1 The student has understood and assimilated the contents of the subject.

R2 The student is able to solve problems or case studies related to the subject contents, by using different resources (bibliographic, IT, etc.)

R3 The student is able to work in a laboratory, carrying out basic operations correctly and taking into account the corresponding safety standards. He/she understands the planning, development and purpose of the experience, and is able to contrast and validate the obtained results.

R4 The student is able to write an intelligible and organized text on different aspects of the subject.

R5 The student is able to present and defend his/her work adequately.

R6 The student seeks bibliographic information from different sources and can analyze it with a critical and constructive spirit.

R7 The student collaborates with the teacher and his/her peers throughout the learning process; he/she works in a team; treats everyone with respects, is proactive and fulfills the organization rules of the course.

Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

BASIC		Weighting			
		1	2	3	4
CB1	Students acquire and understand knowledge in their field of study based on general secondary education but usually reaching a level that, although supported on advanced text books, also includes aspects involving state-of-the-art knowledge specific to their area.		x		
CB2	Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study.			x	
CB3	Students are able to collect and interpret relevant data (generally in their field of study) and give opinions that involve reflection on relevant social, scientific or ethical issues.			x	
CB4	Students can communicate information, ideas, problems and solutions to a specialized or non-specialized audience.				x
CB5	Students develop the necessary learning skills to undertake further studies with a high level of autonomy.			x	

GENERAL		Weighting			
		1	2	3	4
CG01	Capacity to analyze and synthesize.			x	

SPECIFIC		Weighting			
		1	2	3	4
CE22	Knowing and understanding contents, principles and theories related to biotechnology.		x		

CE23	Knowing how to use laboratory equipment and to carry out basic operations for each discipline including: safety measures, handling, waste disposal and activity register.		x		
CE24	Knowing basic and instrument laboratory techniques in the different areas of biotechnology.	x			
CE25	Knowing how to analyze and understand scientific data related to biotechnology.		x		
CE26	To understand and identify the mechanisms that influence genetic inheritance	x			
CE27	Knowing and applying action plans and assessment criteria of biotechnology processes.	x			
CE28	Integrating life science and Engineering into processes of development of biotechnological products and applications.		x		
CE29	Contrasting and checking results of biotechnological experimentation.			x	
CE30	Solving and analyzing problems posed by biotechnology.		x		
CE31	Describing and calculating important variables of processes and experiments.			x	
CE32	Knowing how to use different specific operating systems and software packages designed for Biotechnology.	x			
CE33	Knowing and complying with legislation and ethics of biotechnological processes and applications.	x			
CE34	Knowing main characteristics of Molecular biosciences and biotechnology communication.	x			

TRANSVERSAL		Weighting			
		1	2	3	4
CT02	Capacity to organize and plan.			x	
CT03	Mastering Spanish oral and written communication.		x		
CT05	Knowing and applying Basic ITC skills related to Biotechnology.			x	
CT06	Capacity to manage information (capacity to look for and analyze information coming from different types of sources).				x

CT07	Problem solving.	x			
CT08	Decision making	x			
CT09	Capacity to work in interdisciplinary and multidisciplinary team.		x		
CT10	Interpersonal skills.		x		
CT11	Understanding multicultural and diverse environment		x		
CT12	Critical and self-critical capacity.			x	
CT13	Ethics.	x			
CT14	Capacity to learn			x	
CT15	Capacity to adapt to new situations	x			
CT16	Capacity to produce new ideas (creativity)			x	
CT19	Capacity to apply theoretical knowledge		x		
CT20	Research skills				x
CT21	Sensitivity to environmental issues		x		

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4	45,00%	Written test
R4, R5, R6, R7	35,00%	Submission of papers
R2, R3, R5	20,00%	Laboratory test

Observations

According to the general evaluation and qualification regulations, the preferred evaluation system will be by means of continuous evaluation:
The evaluation item “Submission of Papers” (35% of the final grade) will be evaluated following a continuous evaluation system by means of deliveries in which the evolution of the work will be reviewed.

MENTION OF DISTINCTION:
In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with 9 Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

M1 Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.

M2 Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.

M3 Activities carried out in spaces with specialized equipment.

M4 Supervised monographic sessions with shared participation..

M5 Application of multidisciplinary knowledge.

M6 Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.

M7 Set of oral and/or written tests used in initial, formative or additive assessment of the student

M8 Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical , practical and/or small-group tutoring sessions. Work done on the university e-learning.

M9 Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform.

IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
ON-CAMPUS CLASS M1	R1, R2, R6, R7	30,00	1,20
PRACTICAL CLASSES M2	R1, R2, R4, R5, R6, R7	11,50	0,46
LABORATORY M3	R1, R3, R5	3,00	0,12
SEMINAR M4	R1, R7	2,30	0,09
GROUP PRESENTATION OF ASSIGNMENTS M5	R1, R3, R4, R5, R6, R7	8,20	0,33
TUTORIAL M6	R1, R2, R5, R7	3,00	0,12
ASSESSMENT M7	R1, R2, R3, R4, R5, R6, R7	2,00	0,08
TOTAL		**60,00**	**2,40**

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
AUTONOMOUS GROUP WORK M8	R1, R2, R4, R5, R6, R7	18,30	0,73
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, R4, R5, R6, R7	71,70	2,87
TOTAL		**90,00**	**3,60**

Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

Content block	Contents
1. Introduction.	Definition of indicator, environmental indicator and, biological indicator. Potentiality of biological indicators. Concept of bioindicator. Characteristics of bioindicators. Concept of biomarker. Characteristics of biomarkers. Advantages and disadvantages of the use of biological indicators. Selection of biological indicators. Aquatic organisms as indicators of environmental changes
2. The Water Framework Directive and Marine Strategy Framework Directive	Objectives of DMA. Biological Indicators. Ecological status. Reference conditions. Environmental Quality Ratio (EQR). Representation and classification of ecological status. The Marine Strategies as tool for management of marine environment
3. Biological indicators based in macroalgae.	Macroalgal bioassays to evaluate the spatial extent of fish farm effluents. Biotic indexes based on macroalgae. Rhodophyta Ratio/Phaeophyta. CARLIT Index.
4. Biological indicators based in seagrasses.	Bases for the design of indicators. Biotic indexes based on seagrasses. Multivariate indexes: POMI. CYMOX.
5. Biological indicators based in phytoplanktonic organisms.	Effect of nutrients on the phytoplankton community. Phytoplanktonic Indicators. PHYMED index.
6. Biological indicators based on benthic macrofauna.	Benthic organisms as bioindicators of ecological health of oceans. Biotic indexes based on benthic macrofauna: AMBI, BENTIX, BOPA, BO2A, MEDOCC, ITI.

7. Biological indicators based marine vertebrates	Biomonitoring of xenobiotics and processing of samples in samples in spotted dogfish. Fish behavior as biomarkers of biomarkers of the presence of environmental stressors. Flag species as environmental biomarkers: Sea turtles. Seabirds as sentinels of ocean health. the health of the oceans. Cetaceans as bioindicators of ocean health.

Organization of the practical activities:

	Content	Place	Hours
PR1.	CARLIT index application.	Field visit	2,00
PR2.	Study of indicator variables in seagrasses	Laboratory	8,00
PR3.	Biotic index calculation based on phytoplankton communities	Laboratory	2,00
PR4.	Biotic index calculation based on benthic macrofauna	Computer	2,00
PR5.	Biotic index calculation based on benthic macrofauna	Laboratory	6,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
1. Introduction.	3,00	6,00
2. The Water Framework Directive and Marine Strategy Framework Directive	4,00	8,00
3. Biological indicators based in macroalgae.	4,00	8,00
4. Biological indicators based in seagrasses.	6,00	12,00
5. Biological indicators based in phytoplanktonic organisms.	3,00	6,00
6. Biological indicators based on benthic macrofauna.	3,00	6,00
7. Biological indicators based marine vertebrates	7,00	14,00

References

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