Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1102017 **Name:** Agricultural Plant Breeding

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

Module: Elective Courses

Subject Matter: Agricultural Plant Breeding **Type:** Elective

Department: Biotechnology

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

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

Recommended knowledge

Have passed the subject of 3rd year: *Plant Biotechnology* of the Biotechnology Degree

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	70,00%	Written test
R1, R2, R4, R5, R6, R7	15,00%	Submission of papers
R1, R3, R4, R5, R6, R7	15,00%	Laboratory test

Observations

- In order to promediate, a minimum of 5/10 is requires in both written tests
- Attendance at laboratory sessions is mandatory to qualify for passing the subject (in case of absence shall be justified).

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, R4, R5, R6, R7	30,00	1,20
PRACTICAL CLASSES M2	R1, R2, R3, R4, R5, R6, R7	11,50	0,46
LABORATORY M3	R1, R2, R3, R7	3,00	0,12
SEMINAR M4	R1, R2, R4, R6	2,30	0,09
GROUP PRESENTATION OF ASSIGNMENTS M5	R1, R2, R4, R5, R6, R7	8,20	0,33
TUTORIAL M6	R1, R2, R4, R5, R6	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
DIDACTIC UNIT 1: INTRODUCTION TO PLANT BREEDING	Unit 1. Introduction to plant breeding. Plant domestication and places of origin. Unit 2. In vitro tissue culture Unit 3. Direct and indirect morphogenetic pathways Organogenesis and somatic embryogenesis. Callus and suspension cell culture.

DIDACTIC UNIT 2: BIOTECHNOLOGICAL BREEDING METHODS IN PLANTS	**Methods of propagation and germplasm conservation:** Unit 4. Micropropagation Unit 5. Plant Genetic Resources. In vitro Germplasm conservation **Methods to accelerate breeding programs:** Unit 6. Molecular markers and their application to the genetic improvement of crops. Unit 7. Cultivation of haploid cells and double haploids plants obtaining **Methods for generating and analyzing diversity:** Unit 8. Mutagenesis Unit 9. Pollination and in vitro fertilization. Embryo rescue Unit 10. Isolation, culture and protoplast fusion. somatic hybridization. Unit 11. Generation of somaclonal variation. Unit 12. Use of tissue culture for obtaining and maintenance of disease-free plants. **Biotechnological breeding by genetic transformation:** Unit 13. Genetic engineering techniques to confer virus resistance in plants. Unit 14. Obtaining plants resistant to bacterial diseases. Unit 15. biotechnological approaches for fungal stress management in agriculture. Unit 16. Getting insect resistant plants. Unit 17. Biotechnological Applications to weed management. Unit 18. Getting tolerant plants to different types of abiotic stresses. Unit 19. Developments in biotechnology in ornamental crops. Unit 20. Quality improvement in plant foods Unit 21. Molecular farming
DIDACTIC UNIT 3: STUDY OF PROTOCOLS AND PRACTICAL CASES	Analysis of case studies studied in the theoretical contents
DIDACTIC UNIT 4: LABORATORY PRACTICES	- Indirect organogenesis in Daucus carota - Rose Micropropagation. - Genetic transformation and gene regulation.

Organization of the practical activities:

	Content	Place	Hours
PR1.	Sterilization and explant planting	Laboratory	2,00
PR2.	Rose Micropropagation	Laboratory	2,00
PR3.	Indirect organogenesis induction	Laboratory	2,00
PR4.	In vitro shoot subcultures from PR2	Laboratory	2,00
PR5.	Preparation of antibiotic stocks and transformation media	Laboratory	2,00
PR6.	Preparation of bacterial strains and plásmids	Laboratory	2,00
PR7.	Genetic transformation	Laboratory	2,00
PR8.	Analysis of results obtained in PR7	Laboratory	2,00
PR9.	Subcultures and interpretation of obtained results	Laboratory	2,00
PR10.	Practical laboratory case and protocols study	Lecture room	4,50

Temporary organization of learning:

Block of content	Number of sessions	Hours
DIDACTIC UNIT 1: INTRODUCTION TO PLANT BREEDING	2,50	5,00
DIDACTIC UNIT 2: BIOTECHNOLOGICAL BREEDING METHODS IN PLANTS	14,00	28,00
DIDACTIC UNIT 3: STUDY OF PROTOCOLS AND PRACTICAL CASES	4,50	9,00
DIDACTIC UNIT 4: LABORATORY PRACTICES	9,00	18,00

References

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CHAWLA, H.S. 2002. Introduction to Plant Biotechnology. 2nd ed., Science Publishers, Enfield.
CHRISTOU P., KLEE H. 2004. Handbook of Plant Biotechnology. 2 vols. John Wiley & Sons, (eds.) Chischester, England.
GAMBORG O.L., PHILLIPS G.C. 1995. «Plant cell, tissue and organ culture. Fundamental methods». Springer, (eds.) Berlin.
GELVIN, S.B., SCILPEROORT, R. 2000. Plant Molecular Biology Manual. 2nd ed., Kluwer Academic Pub., Dordrecht, The Hague.
HALL, R.D. 1999. Plant Culture Protocols. Humana Press, New Jersey
TRIGIANO,R.N. & GRAY, D.J. 2000. Plant Tissue Culture Concepts and Laboratory Exercises. CRC Press
BURRACO, A. B. 2005. Avances recientes en biotecnología vegetal e ingeniería genética de plantas. Ed. Reverté
ALTMAN, A., & HASEGAWA, P. M. 2012. Plant Biotechnology and Agriculture: Prospects for the 21st Century. Academic Press.
MURPHY, D. 2011. Plants, Biotechnology and Agriculture. CABI