UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: PLANT BIOTECHNOLOGY
Code: 13337
Type: ELECTIVE
ECTS credits: 4.5
Degree: 341 - UNDERGRADUATE DEGREE PROGRAMME IN BIOCHEMISTRY
Academic year: 2023-24
Center: 501 - FACULTY OF ENVIRONMENTAL SCIENCES AND BIOCHEMISTRY
Group(s): 40
Year: 4
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **Mª CARMEN FENOLL COMES** - Group(s): **40**

Building/Office	Department	Phone number	Email	Office hours
Sabatini/029	CIENCIAS AMBIENTALES		carmen.fenoll@uclm.es	Mondays, Tuesdays and Fridays from 1 to 3 p.m., by e-mail appointment .

Lecturer: **Mª DEL MAR MARTIN TRILLO** - Group(s): **40**

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ICAM/0.20	CIENCIAS AMBIENTALES		mariamar.martin@uclm.es	Mondays, Tuesdays and Thursdays from 1 to 3 p.m., by e-mail appointment .

Lecturer: **CLARA BEATRIZ MORENO FENOLL** - Group(s): **40**

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	CIENCIAS AMBIENTALES		Clara.Moreno@uclm.es	

2. Pre-Requisites

Not established

However, students should have passed the following courses: Fundamentals of Cell Biology, Biochemistry, Microbiology and Genetics and Evolution (first year), Gene Expression and its Regulation, Structure and Function of Macromolecules and Cell Signaling, Control and Homeostasis (second year), Molecular Physiology of Plants, Genetic Engineering and Biotechnology, and Molecular Biology of Systems (third year). It is recommended that students have a level of English that allows them to read bibliography and scientific articles relevant to the subject.

3. Justification in the curriculum, relation to other subjects and to the profession

Plant biotechnology is a rapidly expanding field that offers innovative technological applications to an increasingly diversified market. It uses genetic engineering and the growing information generated by omics in all its variants to obtain plants that produce more nutritious or designer foods, in a sustainable and environmentally friendly way; it also uses plants as biofactories for the safe and low-cost production of drugs for medical or veterinary use, renewable industrial materials, new biomaterials or biofuels. In short: it exploits plants to generate goods and services in multiple sectors of activity such as biomedicine, pharmacy, veterinary medicine, agriculture, food, environment and biodiversity, industry or mining.

The skills and knowledge provided by this course have direct application in basic research, as well as in professional areas such as diagnostics and the biotechnology industry.

Students will practice in the design of strategies for genetic modification of plants to obtain useful goods and services in different productive areas through the realization of an individual case study throughout the course.

4. Degree competences achieved in this course

Course competences

Code	Description
E18	To know the principles of the manipulation of nucleic acids, as well as the techniques that allow the study of the gene function and the development of transgenic organisms with applications in biomedicine, industry, environment, agriculture, etc.
G01	To possess and understand the knowledge in the area of Biochemistry and Molecular Biology at a level that, based on advanced textbooks, also includes cutting-edge aspects of relevance in the discipline
G02	To know how to apply the knowledge of Biochemistry and Molecular Biology to professional practice and to possess the necessary intellectual skills and abilities for this practice, including the capacity for: information management, analysis and synthesis, problem solving, organization and planning and generation of new ideas.
G03	Be able to collect and interpret relevant data, information and results, draw conclusions and issue reasoned reports on relevant social, scientific or ethical issues in connection with advances in Biochemistry and Molecular Biology.
G04	To know how to transmit information, ideas, problems and solutions in the field of Biochemistry and Molecular Biology to a specialized and non-specialized public.
G05	Develop those strategies and learning skills necessary to undertake further studies in the area of Biochemistry and Molecular Biology and other related areas with a high degree of autonomy.
	Acquire skills in the handling of computer programs including access to bibliographic, structural or any other type of databases useful in

G06	Biochemistry and Molecular Biology.
T10	Ability to self-learn and to obtain and manage bibliographic information, including Internet resources

5. Objectives or Learning Outcomes

Course learning outcomes

Description

In the professional profile "biotechnology", the student is oriented towards professional activity in the business and pharmaceutical fields; he or she also acquires skills to carry out a professional activity in the field of teaching and research.

Additional outcomes

1. Training in conceptual analysis, synthesis and design in the field of genetic engineering and plant biotechnology.
2. Advanced knowledge of the current state of the art in this field
3. Future prospects for professional development in this field, both nationally and internationally.

6. Units / Contents

Unit 1: Topic 1: Technologies and Trends in Plant Biotechnology

Unit 1.1 Health applications General strategies for the production of biopharmaceuticals in plants Production of therapeutic proteins; monoclonal antibodies; antigens and vaccines 1.2.2. Food applications Macronutrients: modification of protein, starch and lipid composition Micronutrients: biofortification of staple foods. Golden rice. Modification of the accumulation of secondary metabolites and allergens. Nutraceuticals.

Unit 1.2 Applications to improve agricultural production 1.3.1. Resistance to pests and diseases Herbicides. Insects and nematodes. Fungi and bacteria. 1.3.2. Tolerance to environmental stress. New varieties to cope with global warming Tolerance to drought, high temperatures, cold, freezing, salinity, anoxia. 1.3.3. Improving agricultural productivity of crops Modification of photosynthesis and other metabolic processes Phenological (germination, flowering and senescence) and morphological changes.

Unit 1.3 The other tools of agrobiotechnology 1.4.1. Domestication of plant species. The domestication syndrome. Molecular bases. De novo domestication of species with CRIPSR-Cas 1.4.2. Introduction to Plant Breeding. Genetic basis of plant breeding. Obtaining pure lines. Hybrids. Haploids. Introgression. Molecular marker assisted breeding. The Green Revolution.

Unit 2: Topic 2: Development of an individual agro-biotechnology project throughout the course.

Unit 2.1 Definition of the biotechnological objective of the project.

Unit 2.2 Exploration of feasible strategies to achieve the goal

Unit 2.3 Definition of the strategy. Sources of gene elements and vectors; target species; method of genetic modification

Unit 2.4 Genotypic and phenotypic analysis of genetically modified lines

Unit 3: Topic 3: Laboratory practice

Unit 3.1 Searching for a gene to increase drought tolerance. Role of ABA in the transcriptional response to drought of RD29. Purification and quantification of RNA after ABA treatment. Quantification of RD29a expression by RT-qPCR

Unit 3.2 In silico practice

ADDITIONAL COMMENTS, REMARKS

Units 1 and 2 will be developed simultaneously from the beginning of the course, alternating classroom sessions.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E18 G01 G02 G03 G04 G05 G06 T10	0.6	15	Y	Y	The realization of the laboratory practices is obligatory and not recoverable. Its evaluation, by means of a written exam, will be recoverable.
Class Attendance (theory) [ON-SITE]	Lectures	E18 G01 G02 G03 G04 G05 G06 T10	0.6	15	Y	N	Lectures and guided discussions. At least one seminar in charge of active scientists in plant biotechnology is foreseen. Non-recoverable activity
Class Attendance (theory) [ON-SITE]	project-based learning	E18 G01 G02 G03 G04 G05 G06 T10	0.4	10	Y	N	Classroom work and personal tutorials on a practical case throughout the course. Recoverable through personal tutorials
Other on-site activities [ON-SITE]	Assessment tests	E18 G01 G02 G03 G04 G05 G06 T10	0.2	5	Y	Y	Individual presentation and group discussion of the results of the case study (not recoverable); written tests on the seminars and theoretical class (recoverable in the final exams).
Analysis of articles and reviews [OFF-SITE]	project-based learning	E18 G01 G02 G03 G04 G05 G06 T10	0.6	15	N	-	study of scientific articles related to the case study and the seminars
Writing of reports or projects [OFF-SITE]	project-based learning	E18 G01 G02 G03 G04 G05 G06 T10	1.1	27.5	Y	Y	individual elaboration of the case study; elaboration of an informative poster on the designed transgenic line. Recoverable activity with a final presentation
Study and Exam Preparation [OFF-SITE]	project-based learning	E18 G01 G02 G03 G04 G05 G06 T10	1	25	N	-	extension of contents and strategies for the case study
		Total:	**4.5**	**112.5**			
		Total credits of in-class work: 1.8					**Total class time hours: 45**
		Total credits of out of class work: 2.7					**Total hours of out of class work: 67.5**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Oral presentations assessment	36.00%	15.00%	The work done in the practical case will be evaluated and, in the continuous evaluation, the discussions about it in the classroom sessions, culminating with its formal academic presentation. The work will be done individually or in groups of 2 students.
Mid-term tests	22.00%	0.00%	Tests on the theoretical classes and seminars that will be carried out throughout the course and may be recovered in the final exam if they are not passed or in the case of students who have not taken them during the course.
Test	15.00%	15.00%	The laboratory practices will be evaluated by their execution and by means of a written exam.
Theoretical papers assessment	5.00%	5.00%	The quality of a group divulgative poster on the practical work done will be evaluated.
Final test	22.00%	65.00%	Tests on the second part of the theoretical classes and seminars for the students who pass the progress test. Those who have not passed the progress test will be able to recover it in this final exam.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The default mode assigned to the student will be the continuous evaluation. Any student may request a change to the non-continuous evaluation mode (before the end of the class period) by sending an e-mail to the professor, as long as he/she has not completed 50% of the evaluable activities.
The level of understanding of the practical case, the ability to discuss it, its originality and technical development, the use of face-to-face classes and the level of knowledge of the subject will be evaluated.
The completion of the internship is mandatory for all students.
Practicals and theory must obtain a score of at least 4 points out of 10 calculating their weighted average.
The course will be passed with a 5.

Non-continuous evaluation:

Students who have not completed the case study throughout the course will take a final oral test to present their project, which will be evaluated on their level of understanding, originality and technical development. The final written test will assess their knowledge of the subject.
The completion of the internship is compulsory for all students.
Practices and theory must obtain a score of at least 4 points out of 10 calculating their weighted average.
The course will be passed with a 5.

Specifications for the resit/retake exam:

The criteria are the same as in the ordinary exam.
It will consist of a written exam that will evaluate the knowledge acquired during the course, and an oral exam for the evaluation of the practical case. The parts passed in the ordinary exam will be kept for the extraordinary exam.

Specifications for the second resit / retake exam:

The criteria are the same as in the other calls.
It will consist of a written exam on the knowledge acquired and an oral test to present the practical case.
The completion of the internship is compulsory for all students.
Practical and theory must obtain a score of at least 4 points out of 10 calculating their weighted average.
The course will be passed with a 5

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours **hours**

Unit 1 (de 3): Topic 1: Technologies and Trends in Plant Biotechnology

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Other on-site activities [PRESENCIAL][Assessment tests]	2
Study and Exam Preparation [AUTÓNOMA][project-based learning]	15

Group 40:

Initial date: 29-01-2024 **End date:** 05-04-2024

Comment: Units 1 and 2 will be developed simultaneously throughout the course, alternating classroom sessions.

Unit 2 (de 3): Topic 2: Development of an individual agro-biotechnology project throughout the course.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][project-based learning]	10
Other on-site activities [PRESENCIAL][Assessment tests]	2
Analysis of articles and reviews [AUTÓNOMA][project-based learning]	15
Writing of reports or projects [AUTÓNOMA][project-based learning]	27.5
Study and Exam Preparation [AUTÓNOMA][project-based learning]	5

Group 40:

Initial date: 29-01-2024	**End date:** 12-04-2024
Comment: Units 1 and 2 will be developed simultaneously throughout the course, alternating classroom sessions.	

Unit 3 (de 3): Topic 3: Laboratory practice	
Activities	**Hours**
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	15
Other on-site activities [PRESENCIAL][Assessment tests]	1
Study and Exam Preparation [AUTÓNOMA][project-based learning]	5
Group 40:	
Initial date: 12-02-2024	**End date:** 29-02-2024
Comment: The lab practice will be conducted in three different student groups over three weeks.	

Global activity	
Activities	**hours**
Other on-site activities [PRESENCIAL][Assessment tests]	5
Analysis of articles and reviews [AUTÓNOMA][project-based learning]	15
Writing of reports or projects [AUTÓNOMA][project-based learning]	27.5
Study and Exam Preparation [AUTÓNOMA][project-based learning]	25
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	15
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Class Attendance (theory) [PRESENCIAL][project-based learning]	10
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Paul Christou y otros	Cambiar los genes para mejorar el mundo: La ciencia al servicio de la humanidad	Milenio Publicaciones S.L		978-8497435116	2013	contiene 14 aplicaciones biotecnológicas escritas por sus inventores
varios autores	GM Crops: Promise and Reality	Nature, 497 (2 de mayo de 2013)			2013	un número especial de Nature dedicado a cultivos transgénicos
	http://www.nature.com/news/specials/gmcrops/index.html					
	Original updated articles will be provided throughout the course					
A. Slater, N.W. Scott & M.R. Fowler	Plant Biotechnology	Oxford University Press			2008	An overview of current Methods and applications
Chandra, Suman; Lata, Hemant; Varma, Ajit (Eds.)	Biotechnology for Medicinal Plants	Springer			2013	Libro especializado en: Metabolic engineering - Natural products - Phytopharmaceuticals - Secondary plant metabolites
	http://www.springer.com/life+sciences/plant+sciences/book/978-3-642-29973-5					
Francisco Carcía Olmedo	EL INGENIO Y EL HAMBRE: DE LA REVOLUCION AGRICOLA A LA TRANSGENICA	Crítica		9788474238846	2009	la historia de la biotecnología vegetal explicada por un experto español
Neal Stewardt (Editor)	Plant Biotechnology and genetics	John Wiley & Sons Inc.			2008	A colection of specialized chapters on methods and applications