UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: GENETIC ENGINEERING, GENOMES AND ENVIRONMENT
Code: 37347
Type: ELECTIVE
ECTS credits: 4.5
Degree: 340 - UNDERGRADUATE DEGREE PROGRAMME IN ENVIRONMENTAL SCIENCES
Academic year: 2022-23
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	Monday, Tuesday, Wednesday (16 to 17) Appointment via email

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

Building/Office	Department	Phone number	Email	Office hours
ICAM/0.20	CIENCIAS AMBIENTALES		mariamar.martin@uclm.es	Tuesday, Wednesday and Thursday (15 to 16) Appointment via email

2. Pre-Requisites

They have not been established. However, it is recommended to have passed the basic biology courses in order to follow this course correctly.

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

The course complements the knowledge about genes, genomes and genetic engineering treated in a brief and fragmentary way in other subjects.
This knowledge is nowadays indispensable for the study and management of the environment. The numerous and ever-changing tools based on recombinant DNA based on recombinant DNA technologies provide the student with forensic biology skills for environmental monitoring, restoration and conservation. of the environment. State-of-the-art molecular biology technologies will be introduced and their practical applications will be worked on, including species identification and population studies, identification of species and the study of populations and natural or agricultural ecosystems, the modification and editing of genomes or environmental monitoring with biosensors. In addition, the course provides an overview of genetic engineering and biotechnology that takes into consideration the information and tools derived from genomic tools and other global strategies for the identification, study and modification of genes.
During the course the student is expected to acquire scientific criteria for the application and evaluation of these technologies, since this is a rapidly evolving field in which new technologies are continuously emerging. Issues related to professional ethics and the social and economic impact of GMOs will be addressed, in order to develop students' capacity for critical analysis of these aspects.
Finally, the student will obtain a global vision of these fields, their applications and the current economic and labor framework, as well as their future perspectives.

4. Degree competences achieved in this course

Course competences

Code	Description
E01	Ability to understand and apply basic knowledge.
E02	Capacity for multidisciplinary consideration of an environmental problem
E05	Capacity for qualitative data interpretation
E13	Ability to handle software.
T02	To know and apply the Information and Communication Technologies (ICT).
T03	To use a correct oral and written communication.
T04	To know the ethical commitment and professional deontology.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To have specific information on how biotechnology techniques are applied to environmental monitoring, restoration and conservation.

To exercise critical thinking based on the analysis and synthesis of knowledge in molecular and functional biology.

Ability to understand the bases of genetics and know the processes of recombination and inheritance of genes, as well as the structure and function of nucleic acids and proteins.

To train the student in the understanding and application of the scientific method to the study of biological systems at the molecular and cellular levels.

To know and exercise the technical and conceptual bases of the global and specific analysis of genomes.

Initial learning in the use of laboratory instruments for the study of molecular and cellular processes.

To know the conceptual basis of recombinant DNA techniques and how they have their roots in basic sciences. To apply these techniques for environmental

analysis and for the practice of Genetic Engineering, Environmental Biotechnology and the construction, detection and management of genetically modified organisms.

To know the biotechnological tools, adding to the already classic ones, associated with microbiology, the newest ones, which include transgenic microorganisms, plants and animals, through the study of practical cases.

To develop scientific and independent criteria for students to support decision-making in the application of genetic engineering, biotechnology and knowledge of genomes to the study, management and conservation of the environment.

6. Units / Contents

Unit 1: Genetic engineering: identification, study and modification of genes. Topic 1.1 Introduction. The structure of genomes and genes. Expression of genes. Inheritance of genetic material. Genetic variability and horizontal gene transfer. Topic 1.2 DNA modification in vitro: Restriction enzymes. DNA Ligases. DNA polymerases. Topic 1.3 Hybridization of nucleic acids. Detection of DNA, RNA and proteins. Case study: detection of proteins by ELISA Topic 1.4 Polymerase chain reaction (PCR) and its versions and uses. DNA sequencing. Topic 1.5 Gene cloning: vectors and inserts. Selection genes, reporter genes, genes of interest. Topic 1.6 Genetic transformation of plants and animals. Animal cloning and stem cells.

Unit 2: Genomes: global (holistic) approaches to the study of genetic material. Topic 2.1 Gene libraries or gene libraries. Genomic and cDNA libraries. Types of screening for gene of interest identification. Topic 2.2 What are omics: genomics, transcriptomics, proteomics, metabolomics. Cases: environmental metagenomes Topic 2.3 What is Synthetic Biology and what are its applications?

Unit 3: Environmental biotechnology based on genetic engineering: present and future Topic 3.1 Overview of the tools available to prevent, monitor, and remediate environmental problems. Topic 3.2 Case studies: Biosensors. Phytoremediation. Recovery of endangered species

Unit 4: Laboratory practices Topic 4.1 Bioinformatics and gene database management. Topic 4.2 Identification of transgenic plants by PCR Topic 4.3 Species identification using microsatellites

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Final test [ON-SITE]	Assessment tests	E01 E02 E05 T03	0.1	2.5	Y	Y	The final exam will consist of a written exam on the contents worked on during the course. It will be recoverable in the extraordinary exam
Class Attendance (theory) [ON-SITE]	Combination of methods	E01 E02 E05 E13 T02 T03 T04	0.8	20	Y	N	lectures will be alternated with classroom work on problems, practical cases and exercises. The activity is not compulsory but it is recommended, as there will be case studies and and exercises that will be important in the will be important in the evaluation. The activity is not recoverable.
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E01 E05 E13 T02 T04	0.6	15	Y	Y	The realization of the laboratory Practices is compulsory. They include experiments to identify transgenic plants and to determine a molecular marker in different wild species species, by PCR.
Progress test [ON-SITE]	Assessment tests	E01 E02 E05 E13 T03	0.05	1.25	Y	N	Written test to check the progress made. The activity is not recoverable in the final exam
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E01 E02 E05 E13 T02 T03	0.25	6.25	Y	N	collective problem solving and group discussion. The activity is not is not recoverable
Writing of reports or projects [OFF-SITE]	Individual presentation of projects and reports	E01 E02 E05 E13 T02 T03 T04	0.5	12.5	Y	Y	Elaboration of an individual bibliographic work that will be Discussed and presented in the classroom. In the NON-attendance evaluation, the work will be written. The activity is recoverable through individual tutorials and individual oral presentation.
Study and Exam Preparation [OFF-SITE]	Self-study	E01 E02 E05 E13	2	50	N	-	self-study
Other off-site activity [OFF-SITE]	Project/Problem Based Learning (PBL)	E01 E02 E05 E13 T03 T04	0.2	5	N	-	Autonomous resolution of problems and exercises
		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
			There will be an oral presentation (or a written delivery in the

Oral presentations assessment	20.00%	10.00%	case of NON-continuous evaluation) of an individual bibliographic work and discussion about it.
Laboratory sessions	15.00%	15.00%	Performance in the laboratory will be assessed and a written test will be given in the final exam.
Final test	55.00%	75.00%	The final exam will consist of a written test on the theory topics. Understanding and knowledge of the topics of the program will be assessed.
Assessment of problem solving and/or case studies	10.00%	0.00%	They will be evaluated by their completion in the classroom and individual scheduled deliveries.
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 modality assigned by default 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 capacity for autonomous learning, critical reasoning and problem solving will be evaluated, as well as the degree of achievement of the learning outcomes on the subject.
THE evaluation includes the written tests, the resolution of problems in the classroom and the oral presentation of the individual work. The parts not passed during the course can be recovered in the final exam.
The completion of the practicals is compulsory and will be evaluated by means of a written test.
Practices and theory must be passed individually (the weighted average will be calculated from 4 points out of 10 in each part).
The course will be passed with a 5

Non-continuous evaluation:

The capacity for autonomous learning, critical reasoning and problem solving will be evaluated, as well as the degree of achievement of the learning outcomes on the subject by means of a written theoretical exam and a written presentation of a theoretical work.
The completion of the internship is compulsory.
Practical and theory must be passed individually (the weighted average will be calculated on the basis of 4 points out of 10 in each part).
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 all the activities of the course. The parts passed in the ordinary exam will be kept for the extraordinary exam.
Practices and theory must be passed individually (the weighted average will be calculated from 4 points out of 10 in each part).
The course will be passed with a 5

Specifications for the second resit / retake exam:

The criteria are the same as in the other exams.
In order to pass this exam there will only be a final exam that will represent 100% of the grade, as long as the laboratory practices have been carried out

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
						Recent reviews and articles will be provided during the course
Primrose S and Twyman, R	Principles of Gene Manipulation and Genomics	Blackwell		978-1405135443	2006	
Thiemann, W y Palladin, M	Introducción a la Biotecnología.2ª edición	Pearson		978-8478291175	2010	
Brown, T	Genomas. 3ª Edición	Panamericana		978-9500614481	2008	
Clive James	Global Status of Commercialized Biotech/GM Crops: 2016. http://www.isaaa.org	ISAAA	Ithaca, NY.	978-1-892456-66-4	2018	
Cold Spring Harbor Laboratory	DNA learning center https://www.dnalc.org/					Interactive website related to molecular genetics
Department of Molecular & Cellular Biology	The Biology Project http://www.biology.arizona.edu/	Universidad de Arizona				coleccion de herramientas y tutoriales on line