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: 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	Tuesday, Wednesday and Thursday (13:00 to 15:00). Appointment by e-mail

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 (13:00 to 15:00). Appointment by e-mail

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 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.

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 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.

6. Units / Contents

Unit 1: Genetic engineering: tools for identification, study and modification of genes

Unit 1.1 Introduction. Structure of genomes and genes. Expression of genes. Inheritance of genetic material. Genetic variability and horizontal gene transfer.

Unit 1.2 DNA modification in vitro: Restriction enzymes. DNA Ligases. DNA polymerases.

Unit 1.3 Hybridization of nucleic acids. Detection and analysis of DNA and RNA. Protein detection by ELISA

Unit 1.4 Polymerase chain reaction (PCR) and its versions and uses. DNA sequencing.

Unit 1.5 Gene cloning: vectors and inserts. Selection and reporter genes; genes of interest

Unit 1.6 Genetic transformation of plants and animals. Animal cloning and stem cells.

Unit 2: Genomes: global approaches to the study of genetic material

Unit 2.1 Gene libraries. Genomic and cDNA libraries. Types of screening for the identification of the gene of interest.

Unit 2.2 What are omics: genomics, transcriptomics, proteomics, metabolomics. environmental metagenomes

Unit 2.3 What is Synthetic Biology and what are its applications?

Unit 3: Environmental biotechnology based on genetic engineering: present and future

Unit 3.1 Overview of available tools to prevent, monitor, and remediate environmental problems

Unit 3.2 Case studies: Biosensors. Phytoremediation. Recovery of endangered species

Unit 4: Laboratory practice

Unit 4.1 Bioinformatics and gene database management.

Unit 4.2 Identification of transgenic plants by PCR

Unit 4.3 Species identification using microsatellites

ADDITIONAL COMMENTS, REMARKS

The case studies in Topic 3.2. will be developed through seminars given by the students.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Combination of methods	E01 E02 E05 T04	0.8	20	Y	N	Lectures will alternate with classroom work on problems, case studies and exercises. The activity is not compulsory but it is recommended, since there will be practical cases and exercises that 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	0.6	15	Y	Y	The completion of laboratory practices is mandatory to pass the course, and is not recoverable.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E01 E02 E05 T03	0.25	6.25	Y	N	Collective and individual problem solving and group discussion. The activity is not recoverable
Mid-term test [ON-SITE]	Assessment tests	E01 E05 T03 T04	0.05	1.25	Y	N	There will be a mid-term written test for Topic 1. It will be passed with 4 points out of 10. The activity is recoverable in the final exam.
Writing of reports or projects [OFF-SITE]	Individual presentation of projects and reports	E01 E02 E05 T02 T03 T04	0.5	12.5	Y	Y	Elaboration of an individual bibliographic work on a practical case that will be presented orally and discussed in the classroom; in the non face-to-face 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 T02 T04	2	50	Y	N	Autonomous work
Final test [ON-SITE]	Assessment tests	E01 E02 E05 T03 T04	0.1	2.5	Y	Y	The final exam will consist of a written test on the contents of the course. It will be recoverable in the extraordinary call
Other off-site activity [OFF-SITE]	Project/Problem Based Learning (PBL)	E01 E02 E05 T02 T04	0.2	5	Y	N	Autonomous solving of exercises and problems
		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
Mid-term tests	25.00%	0.00%	There will be a written midterm exam at the middle of the course, which will allow for a score of 4 or more points. If it is not passed, it will be recovered in the final exam.
Oral presentations assessment	20.00%	10.00%	There will be an oral presentation (or a written presentation in the case of non-continuous evaluation) of an individual bibliographic work on a case study and discussion of the same.
Final test	30.00%	75.00%	There will be a written test on the subject taught in the second half of the course. If the mid-term test has not been passed, it will be recovered in the final test.
Assessment of problem solving and/or case studies	10.00%	0.00%	Problem solving in the classroom and in scheduled individual deliveries will be valued.
Laboratory sessions	15.00%	15.00%	The performance in the laboratory will be evaluated and there will be a written test on the practices carried out. It is necessary to obtain 4 points out of 10 to pass the course.
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, provided that 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 results on the subject.
of learning 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 may be recovered in the final exam.
The completion of the laboratory 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 results on the subject through a written theoretical exam and a written presentation of a theoretical work.
The completion of the laboratory practice 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 activities passed in the ordinary exam will be kept for the extraordinary exam.
Practical 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 calls.
To pass this exam there will only be a final test that will represent 100% of the grade, as long as the laboratory practicals have been completed.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours **hours**

Unit 1 (de 4): Genetic engineering: tools for identification, study and modification of genes

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	10
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6.25
Study and Exam Preparation [AUTÓNOMA][Self-study]	20
Other off-site activity [AUTÓNOMA][Project/Problem Based Learning (PBL)]	5

Teaching period: 5 WEEKS

Group 40:

Initial date: 29-01-2024 **End date:** 29-02-2024

Comment: EXERCISES AND PROBLEMS TO BE SOLVED ARE IN RELATION TO THIS TOPIC

Unit 2 (de 4): Genomes: global approaches to the study of genetic material

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	6
Mid-term test [PRESENCIAL][Assessment tests]	1.25
Study and Exam Preparation [AUTÓNOMA][Self-study]	15

Teaching period: 2 weeks

Group 40:

Initial date: 01-03-2024	**End date:** 15-03-2024
Comment: The mid-term exam will test topic 1 and will be held in these weeks	

Unit 3 (de 4): Environmental biotechnology based on genetic engineering: present and future	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	4
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	12.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Final test [PRESENCIAL][Assessment tests]	2.5
Teaching period: 4 weeks	
Group 40:	
Initial date: 18-03-2024	**End date:** 12-04-2024
Comment: In this subject the case studies will be worked on and presented orally. The final exam will be held according to the global calendar of the faculty.	

Unit 4 (de 4): Laboratory practice	
Activities	**Hours**
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	15
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Group 40:	
Initial date: 15-04-2024	**End date:** 19-04-2024

Global activity	
Activities	**hours**
Writing of reports or projects [AUTÓNOMA][Individual presentation of projects and reports]	12.5
Class Attendance (theory) [PRESENCIAL][Combination of methods]	20
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	15
Final test [PRESENCIAL][Assessment tests]	2.5
Other off-site activity [AUTÓNOMA][Project/Problem Based Learning (PBL)]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	50
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6.25
Mid-term test [PRESENCIAL][Assessment tests]	1.25
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
No se ha introducido ningún elemento bibliográfico						