



Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1100306 **Name:** Genetic and Molecular Engineering

Credits: 6,00 **ECTS Year:** 3 **Semester:** 2

Module: Bioengineering and Biotechnological Processes

Subject Matter: Genetic Engineering **Type:** Compulsory

Field of knowledge: Ciencias de la Salud

Department: -

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

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Module organization

Bioengineering and Biotechnological Processes

Subject Matter	ECTS	Subject	ECTS	Year/semester
Genetic Engineering	6,00	Genetic and Molecular Engineering	6,00	3/2
Bioreactors	6,00	Bioreactors	6,00	3/2
Biochemical Engineering	6,00	Biochemical Engineering	6,00	3/1
Plant and Animal Biotechnology	6,00	Plant and Animal Biotechnology	6,00	3/2
Cell Culture	6,00	Cell Culture	6,00	3/2
Biotechnological Processes and Products	6,00	Biotechnological Processes and Products	6,00	4/1

Recommended knowledge

Recommended previous courses: Molecular Genetics, Molecular Microbiology of Microorganisms.



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	



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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		



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CT07	Problem solving.			X
CT09	Capacity to work in interdisciplinary and multidisciplinary team.			X
CT10	Interpersonal skills.			X
CT12	Critical and self-critical capacity.	X		
CT13	Ethics.	X		
CT14	Capacity to learn		X	
CT16	Capacity to produce new ideas (creativity)		X	
CT17	Leadership abilities		X	
CT18	Taking initiatives and enterprising spirit		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, R5	50,00%	Written test
R1, R2, R3, R4, R5, R6, R7	40,00%	Submission of papers
R3, R7	10,00%	Laboratory test

Observations

Notes to the assessment system:

- Assignment grades are divided in:
 - i) **Weekly assignments** (10%)
 - ii) **Final research paper** (30%)
- A minimum grade of **5 over 10** is needed both at the **final exam** and **final research paper**.
- Attendance to laboratory and informatics sessions is **compulsory**: a maximum of 1 unjustified absence will be permitted, otherwise access to final exam will not be allowed.
- **Plagiarism** detected in any of the course assignments will result directly in a 4/10 final mark for the course in the corresponding assessment period

MENTION OF DISTINCTION:

According to Article 22 of the Regulations governing the Evaluation and Qualification of UCV Courses, the mention of "Distinction of Honor" may be awarded by the professor responsible for the course to students who have obtained, at least, the qualification of 9 over 10 ("Sobresaliente"). The number of "Distinction of Honor" mentions that may be awarded may not exceed five percent of the number of students included in the same official record, unless this number is lower than 20, in which case only one "Distinction of Honor" may be awarded.

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, R7	20,00	0,80
PRACTICAL CLASSES M2	R1, R2, R4, R5, R6, R7	6,00	0,24
LABORATORY M3	R1, R2, R3, R7	24,00	0,96
SEMINAR M4	R1	4,00	0,16
GROUP PRESENTATION OF ASSIGNMENTS M5	R5	1,00	0,04
TUTORIAL M6	R1, R2, R3, R4, R5, R6, 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	R2, R3, R4, R5, R6, R7	18,00	0,72
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, R4, R6	72,00	2,88
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 – FUNDAMENTS OF GENETIC ENGINEERING	<ol style="list-style-type: none">1. Introduction2. Main laboratory techniques3. Enzymes for DNA manipulation <i>in vitro</i>4. Molecular cloning I: Basic cloning vectors5. Molecular cloning II: Cell systems for cloning6. Molecular cloning III: Cloning methods7. Advanced vectors for cloning in bacteriae and other organisms8. Gene libraries9. Expression of cloned genes10. Changing genes: mutagenesis and gene editing11. Synthetic biology
DIDACTIC UNIT 2 – LABORATORY PROJECTS	<p>BLOCK I: Research project: gene cloning and sequencing (14 sessions)</p> <ol style="list-style-type: none">1. Genomic DNA extraction2. Nested PCR3. Agarose electrophoresis4. Purification of PCR products5. Cloning6. Transformation7. Plasmid purification8. Preparation of DNA samples for sequencing9. Bioinformatic analysis <p>BLOCK II: Gene editing with CRISPR (1 session)</p>



Organization of the practical activities:

	Content	Place	Hours
PR1.	LABORATORY PROJECT	Lecture room	2,00
PR2.	LABORATORY PROJECT	Laboratory	24,00
PR3.	LABORATORY PROJECT	Computer	4,00
PR4.	VISIT TO COMPANY	Technical visit	2,00
PR5.	CASE STUDY THROUGH VIRTUAL LABORATORIO SIMULATIONS	Lecture room	5,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
DIDACTIC UNIT 1 – FUNDAMENTS OF GENETIC ENGINEERING	15,00	30,00
DIDACTIC UNIT 2 – LABORATORY PROJECTS	15,00	30,00



References

Basic references for lecture sessions:

- Blázquez Ortiz, C., Navarro Llorens JM, Rodríguez Crespo, JI (2021). **142 problemas de Ingeniería Genética resueltos paso a paso**. Ed. Síntesis.
- Brown, TA (2020) **Gene Cloning and DNA Analysis: An Introduction**. 8th edition. Ed. Wiley-Blackwell
- Nicholl, D. S. T. (2023). **An Introduction to Genetic Engineering** (4th ed.). Cambridge: Cambridge University Press.
- Real-García, MD., Rausell-Segarra, C., Latorre-Castillo A., (2017). **Técnicas de ingeniería genética**. Ed. Síntesis.

Basic references for laboratory sessions:

- Bio-Rad (2020). **Cloning and Sequencing Explorer Series. Curriculum manual**.

Additional references:

- Hofmann, A., & Clokie, S. (Eds.). (2018). **Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology** (8th ed.). Cambridge: Cambridge University Press.
- Glick, BR and Pattern, CL (2022) **Molecular Biotechnology: Principles and Applications of Recombinant DNA (6th Ed.)** ASM Press.
- Green, MR., Sambrook, J (2012) **Molecular Cloning: A Laboratory Manual** 4th edition. Cold Spring Harbor Laboratory Press.
- Primrose SB, Twyman RM (2006) **Principles of gene manipulation and genomics**. 7th edition. Ed. Blackwell Publishing
- Watson JD, Baket, TA, Bell, SP, Gann, A, Levine, MI Losick, R, (2007) **Molecular Biology of the Gene**. 6th edition. Ed. Pearson-Benjamin Cummings



Addendum to the Course Guide of the Subject

Due to the exceptional situation caused by the health crisis of the COVID-19 and taking into account the security measures related to the development of the educational activity in the Higher Education Institution teaching area, the following changes have been made in the guide of the subject to ensure that Students achieve their learning outcomes of the Subject.

Situation 1: Teaching without limited capacity (when the number of enrolled students is lower than the allowed capacity in classroom, according to the security measures taken).

In this case, no changes are made in the guide of the subject.

Situation 2: Teaching with limited capacity (when the number of enrolled students is higher than the allowed capacity in classroom, according to the security measures taken).

In this case, the following changes are made:

1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject will be made through a simultaneous teaching method combining onsite teaching in the classroom and synchronous online teaching. Students will be able to attend classes onsite or to attend them online through the telematic tools provided by the university (videoconferences). In any case, students who attend classes onsite and who attend them by videoconference will rotate periodically.

In the particular case of this subject, these videoconferences will be made through:

☒ Microsoft Teams

☐ Kaltura



Situation 3: Confinement due to a new State of Alarm.

In this case, the following changes are made:

1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject, as well as the group and personalized tutoring, will be done with the telematic tools provided by the University, through:

☒ Microsoft Teams

☐ Kaltura

Explanation about the practical sessions:

In case of a COVID19-derived lockdown, laboratory sessions will be substituted by virtual laboratory case study simulations.



2. System for Assessing the Acquisition of the competences and Assessment System

ONSITE WORK

Regarding the Assessment Tools:

- ☐ The Assessment Tools will not be modified. If onsite assessment is not possible, it will be done online through the UCVnet Campus.
- ☒ The following changes will be made to adapt the subject's assessment to the online teaching.

Course guide		Adaptation	
Assessment tool	Allocated percentage	Description of the suggested changes	Platform to be used
Final exam	50	If needed, the final test will be done using digital platforms.	UCVnet
Laboratory assessment	10	If practical sessions cannot be performed due to sanitary reasons, this item will assess the work done through virtual laboratory simulations.	Labster
Course assignments	40	If practical sessions cannot be performed due to sanitary reasons, the written research project report (30% of final grade) will be done using experimental data from previous years. The weekly assignments (10% of final grade) remain unaltered	UCVnet



The other Assessment Tools will not be modified with regards to what is indicated in the Course Guide.

Comments to the Assessment System:

- Course assignments include:

i) Weekly assignments (10%)

ii) Written scientific laboratory report (30%)

- In both the final exam and the written scientific laboratory report, it is imperative that the student obtains a grade of 5 over 10 to pass the course.

- Plagiarism in any of the course assignments will imply that the student will not pass the course.