1. OVERVIEW

Subject Area	Bioreactors
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	4º
ECTS	9
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	S1-S2
Academic Year	24-25
Coordinating professor	Paloma C Santos Moriano

2. INTRODUCTION

Bioreactors focuses on teaching the basic operation of biological reactors. It deals with transport phenomena and material and energy balances, moving on to ideal bioreactors and industrial scaling. It also looks at the separation processes of bioproducts and technical questions related to bioprocesses.
The aim of this subject area is to understand biotechnological processes, kinetics and cell culture control, together with the basic operation of bioreactors.

3. LEARNING OUTCOMES (RA, by the acronym in Spanish)

Knowledge (CON, by the acronym in Spanish)
CON05. Identify techniques involved in biocatalysis and the operation and applications of a bioreactor in industry.
· Identify the different types of interactions between microorganisms and the means of activity.

Abilities (HAB, by the acronym in Spanish)
HAB04. Design experimental procedures and protocols choosing the most suitable technique in the field of biotechnological research, all the while meeting quality and legislative standards.
· Apply immobilisation of biocatalyser techniques and analyse their involvement in the kinetics of the process.
· Apply the equations for the basic design of enzymatic and microbial bioreactors.
· Apply the characteristics of the biotechnological production processes, their analysis, monitoring and scaling criteria to the design of bioreactors.
Skills
COMP03. Apply the laws and principles of physicochemical processes which govern biological systems.
COMP08. Design and execute operation protocols for bioreactors and purification of biotechnological products.

COMP18. Identify and apply mathematical methods and tools to the field of biotechnology.

4. CONTENTS

- Product separation and purification processes and sequences. Separation strategies.
- Types of bioreactors. Basic equations for designing ideal reactors.
- Designing real reactors (discontinuous and continuous). Feeding systems. Reactors in series. Change of scale.
- Instruments and control of bioprocesses.
- Biosensors: types and operation. Applications of biosensors.
- Bioprocess technology.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture
- Collaborative learning
- Project-based learning
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	58
Asynchronous master lectures	17
Debates and discussions	2
Case Studies	4
Problem-solving	8
Spoken presentations	1
Written reports and essays	3
Tutorials	30
Independent working	75
Workshops and/or lab work	15
On-campus knowledge tests	12
TOTAL	**230**

7. ASSESSMENT

The assessment methods, together with how much they each count towards the final grade for the subject area, are as follows:

On campus:

Assessment system	Weight
On-campus knowledge tests	55
Spoken presentations	10
Case study/problem scenario	15
Laboratory practice	15
Project/Final Degree Project	5

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a mark of 5.0 or more out of 10.0 in all assessed parts of the subject. Any part you do not pass in the ordinary exam period will need to be recovered in the extraordinary exam period (resits).

Your final grade will be the average of the partial marks in each of the learning activities you have passed. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes.

It is compulsory for students to accredit attendance to at least 50% of classes. This requirement is essential to the assessment process and qualifies students for the right to obtain academic counselling, support and monitoring from the professor. To this end, students must use the technological means made available by the University to accredit their daily attendance to each of their classes. This system will also serve to guarantee an objective record of the active role of the students in the classroom. Failure to accredit attendance to at least 50% of the classes by any of the means proposed by the University will mean that the professor awarding a fail to the student for that subject area in the ordinary exam period in accordance with the grading system outlined in these regulations. All of the above, without prejudice to the other requirements or higher attendance percentages that other faculties may stipulate in their learning guides or internal regulations. Regulations for the assessment of official degree programmes, Art. 1 point 4. (http://www.uem.es/myfiles/pageposts/reglamento_evaluacion_titulaciones_oficiales_grado.pdf).

7.2. Extraordinary exam period (resits)

To pass the subject area in the extraordinary exam period (resits), the students must obtain a mark equal to or above 5.0 out of 10.0 in all parts of the subject assessment they did not pass during the ordinary exam period.

The student must submit the activities not passed in the ordinary exam period taking into account the corrections or comments made by the teacher. The student must also submit any activities which were not submitted.

The final grade will be the average of the partial marks in each of the activities passed (with a mark equal to or higher than 5 out of 10). The marks for the assessable activities the student passed in the ordinary exam period will be maintained for calculating this grade.

8. TIMELINE

The timeline with delivery dates of assessable activities in the subject area is indicated in this section:

Assessable activities	Date
Laboratory work	**Week 10-13 (S1)**
PO1	**Exams week S1**
Activity in group 1	**Week 7 and 8 (S2)**
University of Mondragón challenge	**Week 1 (S2)**
PO2	**Exams week S2**

The timeline may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The reference work for following this subject area is:

- P. Doran, Principios de ingeniería de los bioprocesos, Acribia, Zaragoza 1995.
- M. Diaz, Ingeniería de bioprocesos, Paraninfo, Madrid, 2012.
- P. A. Belter, Downstream processing for biotechnology, Wiley, 1988.
- R. G. Harrison, Bioseparations science and engineering, OUP USA. 2015.

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit (ODI in Spanish) offers support throughout your time at university to help you with your academic achievement. Other cornerstones of our educational policy are the inclusion of students with special educational needs, universal access in all our university campuses and equal opportunities.

This ODI unit offers students:

1. Support and monitoring through counselling and personalised student plans for those who need to improve their academic performance.
2. Curricular adaptations to uphold diversity, with assistance for those students who require specific educational support, leading to equal opportunities without significant changes to methodology or evaluation.
3. We offer students a range of extracurricular educational resources to reinforce skills which will enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:
orientacioneducativa@universidadeuropea.es

11. SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the course.

Many thanks for taking part.