1. OVERVIEW

Subject Area	Plant biotechnology
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	3
ECTS	3
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	S6
Academic Year	24-25
Coordinating professor	Alejandro Barriga Torrejón

2. INTRODUCTION

Plant Biotechnology is a compulsory subject area worth 3 ECTS and is taught each semester in the second semester of the third year of the Bachelor's Degree in Biotechnology and the fourth year of the Combined Degree in Pharmaceuticals and Biotechnology. This subject area belongs to the BIOTECHNOLOGY PROCESSES AND INDUSTRIAL APPLICATIONS module which is worth a total of 32 ECTS and consists of 4 compulsory subjects: Biotechnological Processes and Products, Bioreactors, Experimental Biotechnology, Pharmaceutical Biotechnology and Plant Biotechnology.

Plant Biotechnology in particular provides students with a global outlook of the most common techniques for improving plants and the use of biotechnology in agriculture, industry, pharmaceutics and so on. In this subject, students will understand the main physiological processes of plants and how they can be manipulated to obtain crops with better characteristics. Students will also learn the main techniques of plant propagation and manipulation in vitro and we will look at the available methods for plant improvement.

Plant Biotechnology is multidisciplinary and transversal with the rest of the subjects studied on this degree course. To better understand the concepts explained in this subject, we recommend have previously passed the subjects Plant Physiology, Biochemistry, Biology, Molecular Genetics and Molecular Genetic Engineering.

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

KNOWLEDGE (CON, by the acronym in Spanish)

CON07. Describe the biotechnological production procedures of biological drugs, food and plants, together with their applications.

- Understand the main haploid production strategies.
- Know the main biotechnological applications of plants.

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 the most suitable techniques for transformation of plant cells, micro propagation and in vitro culture of plants.
- Design prevention or treatment strategies for biotic and abiotic pathological processes in plants.
- Apply crop improvement techniques for manipulating physiological plant processes.

SKILLS

COMP09. Identify and apply tools and techniques used in genetic and genomic engineering, both in experiments and *in silico*.

4. CONTENTS

This subject deals with the following topics:

- Definition and general concepts.
- Morphology: cytology, histology, anatomy and organography.
- Functions of plants, response mechanisms to light and nutrients, photosynthesis, physiology of pollination and defence mechanisms.
- Molecular growth and development processes. Plant hormones.
- Secondary metabolism of plants. Natural raw materials used in pharmaceutics.
- In vitro culture of plant tissue for obtaining and developing plants by organogenesis and somatic embryogenesis.
- Transgenic organisms and their applications in agriculture, medicine and industry.
- Social aspects (health and environment) of genetically modified organisms.

To teach this subject area, this subject is divided into the following units:

- Topic 1. Morphology and structure of plant organisms.
- Topic 2. Plant reproduction.
- Topic 3. In vitro culture of plants.
- Topic 4. Conventional genetic improvement.
- Topic 5. Biotechnological genetic improvement.
- Topic 6. Legal and social aspects of genetically modified crops.
- Topic 7. Photosynthetic metabolism.
- Topic 8. Secondary metabolism.
- Topic 9. Phytopathology: biotic stress.
- Topic 10. Phytopathology: abiotic stress.
- Topic 11. Plant development responses.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture.
- Case study
- Learning based on workshops/labs

6. LEARNING ACTIVITIES

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

Learning activity	Number of hours
Lectures	16
Asynchronous master lectures	7
Debates and discussions	1
Case Studies	10
Written reports and essays	3
Tutorials	7
Independent working	20
Workshops and/or lab work	8
On-campus knowledge tests	3
TOTAL	**75**

7. ASSESSMENT

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

Assessment system	Weight
On-campus knowledge tests	55%
Reports and written work	20%
Case study/problem scenario	10%
Laboratory work	15%

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 grade of 5.0 or more out of 10.0 in the final grade (weighted average according to the percentages in the table above) for the subject area. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes. Also take into account that there are compulsory activities and/or those with a minimum mark:

It is compulsory for students studying degrees on-campus to accredit attendance to at least 50% of classes. This requirement qualifies students for the right to obtain academic counselling, support and monitoring from the professor. 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.

(*https://universidadeuropea.com/documents/1798/6.__Reglamento_evaluacion_titulaciones_oficiales_grado_UEM_v2.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
On-campus knowledge test	Week 41 or 42
Debate	Week 31
Practical case	Week 39
Digital activities	Several dates throughout the course
Laboratory practice	Weeks 31, 33 and 34

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:

- Taiz, L. and Zeiger, M. 2015 **Plant physiology and development**, 6th edition. Sinauer Associates, Inc.
- García del Moral Garrido, L.F. 2021. **Biotecnología vegetal**. Editorial Universidad de Granada.
- Neal Stewart, C. 2016 **Plant biotechnology and genetics**, 2nd edition. John Wiley and sons, Inc.
- Solomon, E.P., Berg, L.R. and Martin, D.W. (2013). **Biología** (9ª edición). Cencage learning. * existe una edición en inglés más reciente (11th edition, 2019) llamada *Biology*.
- Bahadur, B., Rajam, M.V., Sahijram, L. and Krishnarmurthy, K.V. 2015 **Plant biology and biotechnology**, 2 vols., Springer.
- Ranabhatt, H. and Kapor, R. 2018 **Plant biotechnology**, Woodhead Publishing.

The recommended bibliography is indicated below:

- Nuemann, K.H., Kumar, A., and Imani, J. 2009 Plant cell tissue culture – A tool in biotechnology. Springer.
- Bhojwani, S.S., Dantu, P.K. 2013 Plant tissue culture: An introductory text. Springer.
- Escaso Santos, E., Martínez Guitarte, J.L. y Planelló Carro, M.R. 2010 Fundamentos básicos de fisiología vegetal y animal. Pearson Educación S.A.
- Echenike, V., Rubistein, C., Mroginski, L. 2004. Biotecnología y mejoramiento vegetal. Instituto Nacional de Tecnología Agropecuaria (INTA).

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.