1. OVERVIEW

Subject Area	Industrial Microbiology
Degree	Bachelor's Degree in Biotechnology / Bachelor's Degree in Pharmacy and Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	2nd
ECTS	3
Type	Compulsory
Language(s)	English
Delivery Mode	On campus
Semester	S2
Academic Year	25-26
Coordinating professor	Mónica Martínez Martínez
Teacher	Mónica Martínez Martínez

2. INTRODUCTION

Industrial Microbiology is one of the compulsory subjects in the Degree in Biotechnology syllabus at the Universidad Europea de Madrid. Industrial Microbiology is the branch of Microbiology which deals with how microorganisms are used in products of use to humans, such as food, biopolymers or antibiotics. They are also involved in environmental processes such as leaching, bioremediation and so on. It is a particularly relevant subject area in the field of microbiology as the use of microorganisms or the molecules which derive from them, such as enzymes, provide a series of advantages on an environmental and economic level regarding organic synthesis or chemical purification or remediation processes. These help to contribute to sustainable development.
Therefore, Industrial Microbiology teaches students the importance of microorganisms beyond their role as pathogens or pollutants, reinforcing the importance they have in different fields of industry such as pharmaceuticals or food. This also includes processes such as bioremediation and bioleaching. Subject matter is taught through theory, practical sessions, industry field trips, seminars and more.

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

Knowledge (CON, by the acronym in Spanish)

CON02. Recognise the structure, organisation and function of tissues, organs and systems, viruses and cells, as well as the processes which occur in them. Know the fundamentals of microbial growth and metabolism, the different groups of microorganisms and their capacity to create diseases.
• Know the basic laboratory techniques, being familiar with the different instruments and techniques used in microbiology and know how to perform simple microbiological diagnosis techniques.

• Recognise the different cell types and their basic components using a microscope.
• Know the structure and biology of viruses, viroids and prions and understand the viral replication processes and the interactions between viruses and cells.

Abilities (HAB, by the acronym in Spanish)
HAB02. Use samples and laboratory techniques all the while maintaining the appropriate safety and quality measures in each laboratory.
• Obtain and process samples for microbiological study.

Skills
COMP06. Develop the skills needed to use the most common equipment, instruments and basic techniques in biotechnology, following quality standards and current biosecurity regulations.
COMP20. Identify and analyse the characteristics of the microorganisms and their biotechnology applications.

4. CONTENTS

- Isolation, selection, improvement and development of strains of microorganisms of industrial interest.
- Scale-up of fermentation, pilot and industrial.
- Production of primary and secondary metabolites: product examples.
- Food production.
- Waste water purification.

The subject area is divided into 3 learning units, which are then divided into topics (2 or 3 topics depending on the unit):

UA1. INTRODUCTION TO INDUSTRIAL MICROBIOLOGY. BASIC CONCEPTS

Topic 1. Introduction to Industrial Microbiology.

- 1.1. Biotechnology and Industrial Microbiology.
- 1.2. Characteristics of Industrial Microbiology.
- 1.3. Historical Development of Microbiology.
- 1.4. Bioterrorism.
- 1.5. Future perspectives.

Topic 2. Main microbial products and processes of interest.
- 2.1. Microbial products and processes.
- 2.2. Industrial microbial products of interest: metabolites, enzymes, microorganisms.
- 2.3. Industrial microbial processes of interest: biotransformation, residual water treatment, bioremediation, bioleaching, fermented food.

UA 2. MICROORGANISMS OF INDUSTRIAL INTEREST. FERMENTATION.

Topic 3. Microorganisms of industrial use.

- 3.1. Microorganisms against animals and plants.
- 3.2. Characteristics of industrial microorganisms.
- 3.3. Search for microorganisms.
- 3.4. Preservation of microorganisms.
- 3.5. Microorganisms of industrial use: bacteria, fungi, micro algae.

Topic 4. Estimating bacterial biomass: count in mass and estimation of the number of individuals.

- 4.1. Microbial growth.
- 4.2. Evaluation methods of microbial growth: direct and indirect methods.

Topic 5. Fermentation systems.

- 5.1. Parameters: agitation speed, transfer of oxygen, pH, temperature, foam formation.
- 5.2. Parameter control systems.
- 5.3. Fermentation systems: Batch, fed batch and continuous.
- 5.4. Other classifications.
- 5.5. Development of the fermentation process.

UA 3. FOOD MICROBIOLOGY.

Topic 6. Food microbiology.

- 6.1. Introduction to food microbiology.
- 6.2. Growth of microorganisms in food.
- 6.3. Microbial deterioration of food.
- 6.3. Controlling microbial deterioration of food.
- 6.4. Removal of microorganisms and conservation.

Topic 7. Food borne diseases.

- 7.1. Types of transmission.
- 7.2. Diseases produced by viruses.
- 7.3. Diseases produced by prions.

7.4. Diseases produced by bacteria.

- 7.5. Diseases produced by protozoa.

Topic 8. Microbiology of fermented food.

- 8.1. Fermented milk.
- 8.2. Cheese production.
- 8.3. Meat and fish.
- 8.4. Production of alcoholic beverages.
- 8.5. Production of bread.

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	16
Asynchronous master lectures	6
Case Studies	2
Oral presentations	1
Written reports and essays	4
Tutorials	7
Autonomous working	25
Workshops and/or laboratory work	8
Scientific research and projects	3
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:

On campus:

Assessment system	Weighting
On-campus knowledge tests	60%
Learning activities (reports and written work, Spoken presentations, case study/problem)	20%
Laboratory work	20%

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:

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.

Assessable activities	Date
PBL: La Sagra brewery	Week 3
PBL: Delivery of initial proposal. Organic chemistry workshop:	Week 4
Delivery of final proposal.	Week 7
Practicals turn 1. G1 and 2	Week 8
Practicals turn 2. G3 and 4	Week 10
Delivery of conceptual map activity.	Week 12
Tasting notes.	Week 16
Objective knowledge test.	Week 18-19

9. BIBLIOGRAPHY

The reference work for following this subject area is:

BASIC BIBLIOGRAPHY:

The recommended bibliography is indicated below:

- Cowan, M.K., 2021. Microbiology: A Systems Approach, 6th ed. McGraw-Hill, Boston etc.
- Murray, P.R., Rosenthal, K.S., Pfaller, M.A., 2013. Medical Microbiology, 8th ed. Elsevier Saunders, Philadelphia.
- Prescott, L.M., Harley, J.P., Klein, D.A., 2014. Prescott's Microbiology, 9th ed. Wm. C. Brown Publishers, Dubuque Iowa.
- Okafor, N., 2007. Modern Industrial Microbiology and Biotechnology. Science Publishers, Enfield New Hampshire.
- Waites, M.J., 2001. Industrial Microbiology: An Introduction. Blackwell Science Ltd., Osney Mead, Oxford.
- Verma, P. 2023. Industrial Microbiology and Biotechnology : Emerging concepts in Microbial Technology, 1sr ed. Singapore Springer Nature Singapore.

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 degree.

Many thanks for taking part.