1. OVERVIEW

Subject Area	Advanced Instrumental Techniques
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	S1
Academic Year	24-25
Coordinating professor	Viviana Negri

2. INTRODUCTION

Advanced Instrumental Techniques is part of the compulsory Instrumental Techniques module which is taught throughout the degree course and is worth 9 ECTS divided between years 1 and 3 in two different subjects (Basic Instrumental Techniques and Advanced Instrumental Techniques). This subject belongs to the Instrumental Methods and Biochemical Engineering module worth a total of 36 ECTS. It is a compulsory subject (worth 3 ECTS) taught each semester during the third year of the Degree in Biotechnology.

The main aim of this subject area is to familiarise students with the basic concepts and principles of advanced analysis techniques, both qualitative and quantitative, which are most common in the study of molecules of biotechnological interest. In studying these techniques, we deal with aspects related to their theory and the equipment required in each case, together with their applications in the field of biotechnology. The aim is for students to understand the fundamentals of the techniques so they can understand results obtained by other authors using these tools, and be able to use them themselves in the future.

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

Knowledge (CON, by the acronym in Spanish)

CON04. Identify the techniques and principal methods of cell cultures, protein analysis from a biotechnology standpoint and genetic bases and their application in industry.

- Learn the main spectroscopic methods and know how to interpret different types of spectroscopies to identify molecular structure.
- Show good knowledge of the x-ray diffraction methods, basics and main applications of nuclear magnetic resonance and mass spectrometry.

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.

- Understand the basics and main applications of the different types of microscopy.

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.

COMP08. Design and execute operation protocols for bioreactors and purification of biotechnological products.

4. CONTENTS

· Microscopy.
· X-ray diffraction.
· Nuclear magnetic resonance.
· Mass spectrometry.
· Other analytical techniques used in biotechnology.

The subject area is divided into three learning units, which are then divided into two or three topics depending on the unit:

Unit 1. GENERAL APPLICATION TECHNIQUES

- Topic 1. Introduction.
- Topic 2. Radiochemistry methods.

Unit 2. STRUCTURE ANALYSIS TECHNIQUES

- Topic 3. Nuclear magnetic resonance.
- Topic 4. Mass spectrometry.
- Topic 5. X-ray diffraction.

Unit 3. STRUCTURE OBSERVATION TECHNIQUES

- Topic 6. Optical microscope.
- Topic 7. Electron microscope.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture.
- Collaborative learning.
- Problem-based learning.
- Learning based on workshops/laboratory work

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	9.5
Case Studies	2
Problem-solving	0
Spoken presentations	1
Written reports and essays	3
Tutorials	7
Independent working	24
Workshops or laboratory activities	10
Research work and projects	0
On-campus knowledge tests	2.5
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	Weight
Knowledge tests	60%
Spoken presentations	5%
Case study/problem scenario	5%
Reports and written work	15%
Laboratory practice	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 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 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
Activity 1. Solving practical cases and application exercises (1)	Week 5
Activity 3. Laboratory work	Week 6-13
Activity 4. Objective knowledge test 1	Week 10

Activity 1. Solving practical cases and application exercises (2)	Week 13
Activity 1. Solving practical cases and application exercises (3)	Week 14
Activity 2. Integrated knowledge activity	Week 18
Activity 3. Objective knowledge test 2	Week 19-20

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:

- Principles of instrumental analysis (6th Edition). Skoog DA, Holler FJ, Crouch SR. Cengage Learning. 2007.
- Técnicas de Bioquímica y Biología Molecular. D. Freifelder. Ed. Reverté. 1991.
- Mass Spectrometry: Developmental Approaches to Answer Biological Questions. Pottiez G. Springer, 2015.
- Introducción a la microscopía electrónica aplicada a las ciencias biológicas. Vázquez Nin G, Echeverría O. Universidad Nacional Autónoma de México, Facultad de Ciencias: Fondo de Cultura Económica, 2000.
- Structure Determination of Organic Compounds, Tables of Spectral Data. Martin Badertscher , Philippe Bühlmann , Ernö Pretsch. Springer, 2009.

The recommended bibliography is indicated below:

- Physical Chemistry for the Life Sciences. Peter Atkins, Julio de Paula. Oxford University Press, 2006.
- Physical chemistry: principles and applications in biological sciences. Ignacio Tinoco, Jr. Prentice-Hall, 2002. 4th edition.
- Métodos ópticos de análisis. Olsen, E.O. Editorial Reverté, Barcelona España, 1990.

Websites of interest:
RMN: Spectral Database for Organic Compounds, SDBS:
https://sdbs.db.aist.go.jp/sdbs/cgi-bin/cre_index.cgi
RMN: Web de simulaión de espectros mono y bidimensionales
https://www.nmrdb.org/
MS: https://massbank.eu/MassBank/Search
MS: Mass Spectrometry data Center:
https://chemdata.nist.gov/dokuwiki/doku.php?id=chemdata:interpreter

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.