# 1. OVERVIEW

| | |
|---|---|
| **Subject Area** | Basic Instrumental Techniques |
| **Degree** | Bachelor's Degree in Biotechnology |
| **School/Faculty** | School of Biomedical and Health Sciences |
| **Year** | 1º |
| **ECTS** | 6 |
| **Type** | Compulsory |
| **Language(s)** | Spanish and english |
| **Delivery Mode** | On campus |
| **Semester** | S1 |
| **Academic Year** | 25-26 |
| **Coordinating professor** | Cira García de Durango |
| **Professor** | Cira García de Durango |

# 2. INTRODUCTION

Basic 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).

Basic Instrumental Techniques is a compulsory subject worth 6 ECTS and is taught each semester in the first year of the Bachelor's Degree in Biotechnology. The main aim of this subject area is to teach students the basic instrumental techniques generally used in analysis laboratories in the biotechnology sector.

In studying these techniques, we deal with aspects related to their theory and the equipment required in each case. Knowledge of the main instrumental techniques is fundamental for any professional in the biotechnology sector when it comes to performing research, quality control or clinical analysis tasks.

# 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.

1. Learn the main spectroscopic methods and know how to interpret different types of spectroscopies to identify molecular structure.
2. Have sound knowledge of the basics of separation through centrifugation, using chromatographic techniques (in its wide range of forms and applications) and electrophoretic techniques. Also know how to apply these to protein and/or nucleic acid analysis.

3. Show good knowledge of the x-ray diffraction methods, basics and main applications of nuclear magnetic resonance and mass spectrometry.

## Skills(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.

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

## Competencies

**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

Introduction to the instrumental techniques of analysis
· Electroscopy techniques.
· Molecular spectroscopy (ultraviolet/visible, fluorescence, infra-red)
· Separation techniques: centrifugation, chromatography and electrophoresis

This subject area is divided into three learning units, which are then divided into various topics:

**Unit 1. Introduction.**

- TOPIC 1. Introduction to instrumental techniques: Analytical methods. Measurement. Types of errors. Error detection. Discrepancies in results. Calibration methods.

**Unit 2. Spectroscopy methods.**

- TOPIC 2. Introduction to Spectroscopy techniques: Basic concepts of spectroscopy. Lambert-Beer´s law. Instruments in general.
- TOPIC 3. Molecular absorption spectroscopy UV/Vis: Absorbance and transitions. Effects on absorption. Applications. Specific instruments.
- TOPIC 4. Fluorescence, phosphorescence and molecular chemiluminescence spectroscopy: theory of fluorescence and phosphorescence. Application of luminescent methods. Specific instruments.

**Unit 3. Methods of separation and cell determination**

- TOPIC 5. Optical microscope. General aspects. Bright and dark field microscopy. Phase-contrast microscopy. Polarized light microscopy and differential interference contrast (DIC) microscopy.
- TOPIC 6. Chromatographic techniques: Fundamental concepts of chromatography. Chromatography of gases. Chromatography of liquids. Applications.
- TOPIC 7. Electrophoresis: fundamental concepts of electrophoresis. Types of electrophoresis. Capillary electrophoresis. Gel electrophoresis. Applications.
- TOPIC 8. Centrifugation: Fundamental concepts of centrifugation. Analytical and preparative centrifugation. Applications.

# 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 | On-campus % |
|---|---|---|
| Lectures | 26 | 100 |
| Asynchronous master lectures | 6.5 | 0 |
| Case Studies | 13 | 25 |
| Problem-solving | 32 | 20 |
| Spoken presentations | 2 | 100 |
| Written reports and essays | 5 | 0 |
| Tutorship | 13 | 100 |
| Independent working | 30 | 0 |
| Workshops and/or lab work | 14 | 100 |
| Scientific research (case studies and projects) | 3 | 100 |
| On-campus knowledge tests | 5.5 | 100 |
| **TOTAL** | **150** | |

## 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 |
|---|---|
| Reports and written work. | 15% |
| Laboratory practice | 10% |
| Case study/problem | 10% |

| | |
|---|---|
| Spoken presentations | 5% |
| On-campus knowledge tests | 60% |

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 be able to take the theory exam in the ordinary exam period, you must have attended and passed the practical sessions and also have submitted all the compulsory and asynchronous activities. You must also have passed the integrative activity (scientific poster). 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).
Attendance to all practical laboratory sessions is compulsory to be able to pass the practical sessions in the ordinary exam period.
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.*

## 7.2. Extraordinary exam period (resits)

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).

If you have failed any of the practical exercises due to non-attendance at laboratory sessions, you must undertake a theory/practical laboratory exam. To pass this exam, you must obtain a mark greater than or equal to 5.0 out of 10.0.

## 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 numerical problems and applying them. | Week 2-16 |
| **Activity 2.** Laboratory work. | Week 3-11 |
| **Activity 3.** Integrative knowledge activity (scientific post) | Week 15-16 |
| **Activity 4.** On-campus knowledge tests | Weeks 9 and 16 |

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 recommended bibliography is indicated below:


- Fundamentals of Light Microscopy and Electronic Imaging (2nd Edition)
  Douglas B. Murphy, Michael W. Davidson
  Wiley-Blackwell, 2020
  ISBN: 9781119607786
- Basic Techniques in Biochemistry, Microbiology and Molecular Biology (2nd Edition)
  A. D. Miller, J. M. Tanner
  Cambridge University Press, 2023
  ISBN: 9781108947583
- Introduction to Spectroscopy (6th Edition)
  Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan

Cengage Learning, 2023
ISBN: 9780357512053
(Muy recomendado, clásico, actualizado a 2023)

- Principles of Instrumental Analysis (7th Edition)
  Douglas A. Skoog, F. James Holler, Stanley R. Crouch
  Cengage Learning, 2018 (última edición disponible, aún vigente)
  ISBN: 9781337468039
- Chromatography: Basic Principles, Sample Preparations and Related Methods (6th Edition)
  E. Heftmann
  Elsevier, 2021
  ISBN: 9780128146034
- Analytical Chemistry for Technicians (5th Edition)
  John Kenkel
  CRC Press, 2021
  ISBN: 9780367373792
- Gel Electrophoresis: Principles and Basics
  Edited by Sameh Magdeldin
  IntechOpen, 2020
  ISBN: 9781838802180

## 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.