UAB
Universitat Autònoma de Barcelona

Instrumental Techniques

2026/2027

Code: 100998
Credits: 6

Degree programme	Type	Course
Microbiology	FB	2

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the end of the document.

Prerequisites

It is recommended to review the basic concepts of Biochemistry of first year, especially the physical-chemical characteristics of macromolecules.

It is recommended to take this course at the same time as "Laboratori Integrat III" (100978) of this degree.

Objectives

MODULE II: INSTRUMENTAL TECHNIQUES IN BIOCHEMISTRY

The general objective is the students to recognize, compare and evaluate the usefulness of the main techniques the main instrumental techniques

the instrumental techniques that are developed in a laboratory and that they may need throughout their studies and professional activity.

This objective can be specified in:

-Acquire and understand the theoretical basis of the main instrumental techniques
-Application of these techniques in the field of microbiology
-Strengthen the self-learning ability of the student. The student must learn to obtain information and acquire the habit of using this information critically.
-Increase student interest in the technical aspect of science.

Learning outcomes

- CM07 (Critically evaluate, in the field of biochemistry, experimental procedures and data analysis, as well as their results, with a gender perspective and with ethical responsibility and respect for fundamental rights and duties, diversity and social and democratic values.) Critically evaluate, in the field of biochemistry, experimental procedures and data analysis, as well as their results, with a gender perspective and with ethical responsibility and respect for fundamental rights and duties, diversity and social and democratic values.
- CM08 (Integrate knowledge and analysis techniques for the study of biomolecules and their functions, working individually and in groups, to elaborate and present in writing or orally and publicly a scientific work.) Integrate knowledge and analysis techniques for the study of biomolecules and their functions, working individually and in groups, to elaborate and present in writing or orally and publicly a scientific work.
- KM13 (Indicate the theoretical foundations and equipment of the main instrumental techniques to isolate, quantify, characterise and detect biomolecules and metabolites.) Indicate the theoretical foundations and equipment of the main instrumental techniques to isolate, quantify, characterise and detect biomolecules and metabolites.
- SM11 (Apply appropriate techniques for the detection, quantification and purification of biological molecules and to determine the structure of proteins.) Apply appropriate techniques for the detection, quantification and purification of biological molecules and to determine the structure of proteins.

Contents

Module II: INSTRUMENTAL TECHNIQUES IN BIOCHEMISTRY

Unit 1: Basic Principles of absorption spectroscopy. Lambert-Beer Law. Spectrophotometers. Spectroscopic analysis of biopolymers. Fundamentals of spectrofluorimetry. Spectrofluorimeter. Applications.

Unit 2: Centrifugation. Fundamentals.Sedimentation Coefficient. Factors on which the sedimentation coefficient depends. Instrumentation: preparative and analytical ultracentrifuge.

Unit 3. Chromatographic techniques. Introduction. Fundamentals and characteristics. Chromatography type: gel filtration, ion exchange, hydrophobic, affinity. High Performance Liquid Chromatography (HPLC). Gas chromatography.

Unit 4: Purification Strategies of macromolecules. Stages of purification. Optimization of each stage. Preparative techniques of nucleic acids: plasmid DNA, bacteriophage DNA, genomic DNA, total RNA and messenger RNA.

Unit 5: Electrophoretic techniques. Protein and Nucleic acid electrophoresis.

Unit 6. Hybridization techniques: Western-blot, Southern-blot, Northern-blot, Southwesthern, Microarrays, FISH, in situ hybridization. Labeling techniques.

Unit 7: Polymerase Chain Reaction: PCR. Fundamentals of the technique. Primers design . Set up of the reaction. Applications.

Unit 8: Recombinant DNA technology.

Unit 9. Mass spectrometry. MALDI-TOF bacterial identification. Other techniques for biopolymers.

Unit 10: Radioactive isotopes. Kinetics of disintegration. Isotopes used in Biochemistry. Labeling. Methods for LabelingNucleic Acids and Protein. Detection & Measurement of Radioactivity. Protection in the use of radioactive isotopes. Chemiluminescence systems as an alternative to radioactive methods.

Unit 11: Immunological techniques. Preparation of monoclonal and polyclonal antibodies. Antigen-antibody reaction. Examples of Immunotechniques

Unit 12: Electron microscope (TEM / SEM). Sample preparation methods.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Work redaction (seminar)	9	0.36	CM07, CM08, KM13, SM11
Group and individual tutoring about seminars and problems	10	0.4	CM07, CM08, SM11
Seminars Class	3	0.12	CM07, CM08, SM11
Magisterial class	30	1.2	CM07, CM08, KM13
Problem resolution	14	0.56	CM07, CM08, KM13, SM11
Autonomous Study	62	2.48	CM07, CM08, KM13, SM11
Problem Class	12	0.48	CM08, KM13, SM11

Theory classes:

There will be master classes (30 hours). Through this system the basic concepts of the syllabus will be introduced. Whenever possible, audiovisual and interactive material will be used to help the understanding of the concepts.

Problem classes:

Throughout the course, 12 hours will be dedicated to problem class sessions. The group will be divided into two subgroups, the lists of which will be made public at the beginning of the course. Students will attend the sessions scheduled by their group. At the same time, each subgroup will be divided into working teams consisting of 3-4 people that will be maintained throughout the course.

At the beginning of the semester, the dossier of problem statements will be delivered through the Virtual Campus. The teams will solve the problems outside class time. In each of the problem sessions, 2-3 teams will be chosen at random. A representative of the chosen team will present the solution of a problem on the blackboard. At the end of the presentation, the problem will be discussed and, if necessary, corrected with the participation of all students. The teacher will ensure that all teams have, throughout the course, the opportunity

to publicly expose the resolution of problems. As indicated in the evaluation section, the resolution, public exhibition of problems, discussion and correction will be taken into account in the final grade, in addition to the grade obtained in the individual evaluation.

Seminars:

This activity is an activity supervised by the teacher that is carried out in groups (3-4 people) and consists in the reading by the students of articles previously selected by the teacher. Students must understand and analyze the techniques used in each article. The objective of this methodology is that students see real examples of the use of the techniques explained in class and know how to recognize and interpret them.

During the 3 scheduled seminar sessions there will be a presentation, discussion and debate of the figures of the articles worked on.

The objective of these sessions is to facilitate the dialogue between the teacher and the students, helping them to understand the concepts acquired in the master classes.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Seminar summary and Participation during seminar class	5%	0.5	0.02	CM07, CM08, SM11
Theory, problems and seminars written exam	85%	8.5	0.34	CM07, CM08, KM13, SM11
Resolution of exercises in class	10%	1	0.04	CM07, CM08, SM11

Continuous evaluation

1. Theory Module (60%).

Two written tests (60%). The two partial tests will contain short questions that allow relatingconcepts and a block of multiple-choice questions. The two types of questions will have the same weight in each midterm. The final grade is obtained by averaging radess obtained in the two midterm exams. The weight of each midterm in the final grade will be directly proportional to the number of classes during which the subject included in the exam has been taught; in any case, it is guaranteed that each partial will always represent a weight of the final grade within the 25%-35% range.

2. Problems Module (25%).

This module consists of two parts:

2.1. Team evaluation (10% of the total): It is based on the resolution of the problems worked on on in teams and exposed in class. Each time a team presents a problem,, it will receive a grade. If a team is not present in the classroom or refuses to present a problem,, they will receive a grade of 0.

2.2. Individual evaluation (15% of the total) by means of two written tests. Each of the partial tests will consist of the resolution of 1-2 problems. The final grade is obtained by the weighted average of the grade obtained in each of the two tests. The weight of each of the midterm exams in the final grade will be directly proportional to the number of classes during which the subject matter included in the exam has been taught; in any case, it is guaranteed that each partial will always represent a weight of the final grade within the 5%-10% range.

3. Seminar Module (15%)

This section evaluates the student's capacity for analysis and synthesis, as well as group work skills. The evaluation will consist of two parts:

3.1 Participation in the presentation, discussion, and debate of the articles to the seminar class (5%).

3.2 Individual written tests on the figures and tables of the articles worked on on and discussed during the seminar class (10%). The written tests of the seminars will take place at the end of each of the seminar sessions.

The two parts (3.1 and 3.2) are inseparable, sothe student has to participate andbe evaluated inboth to obtain a grade for the seminars. The grade obtained in this module is NOT subject to recovery.

Single Evaluation

1. Theory Module (60%).

On the day marked by the second partial in the calendar of the course, the students who have taken the single evaluation system will take a single written test on the whole of the syllabus of the subject andwill be of two types: short questions that allow relating concepts and a block of multiple-choice questions. The block of short questions and the multiple-choice questions will have the same weight within this single test.

The weight of this single evaluation test of theory will be 60% of the course.

The single evaluation test of theory is recoverable and will take place on the same day as the recovery of the continuous evaluation tests; in this case,, the recovery will also be a single written test with questions of the whole syllabus of the subject, with the same format described in the previous paragraph.

2. Problems Module (25%).

This module consists of two parts:

2.1. Team evaluation (10% of the total): In this teaching typology the same system described in the continuous evaluation will be applied; it will have the same weight as in the continuous evaluation,, and in the same way that the continuous evaluation can NOT be recovered.

2.2. Individual evaluation (15% of the total). On the day marked by the second partial in the calendar of the course, the students who havee taken the single evaluation system will take a single written test consisting of the resolution of 2-4 problems of the set of problems of the whole syllabus of the course. The weight of this single evaluation test of problems will be 15%% of the subject. The single evaluation test of problems is recoverable and will take place on the same day as the recovery of the continuous evaluation tests; in this case,, the recovery will also be a single written test with problems on the whole set of the syllabus of the subject, with the same format described in the previous paragraph.

3. Seminar Module (15%).

In this teaching typology the same system described in the continuous evaluation will be applied. It will have the same weight as in the continuous evaluation and in the same way that the continuous evaluation can NOT be recovered.

General considerations for the two types of evaluation (continuous and single)

- The evaluation of the modules of theory and problems are inseparable,, and in order to pass the course,, the student must participate and be evaluated in both modules. The written tests of theory and problems will be taken together on the scheduled dates already fixed in the calendar.
- On the other hand, in order to pass the course,, it is NOT necessary to be evaluated in the seminar module.
- The grade is obtained by the weighted average of each of the modules: 0.60 (theory) + 0.25 (problems) + 0.15 (seminars) = final grade. To pass the course it is necessary to achieve a final grade equal to or higher than 5.

- This weighted average can only be done in the case that in the evaluations of the theory and problems modules a grade equal to to or higher than 4 has been achieved.
- The students who do not pass the written tests of theory and problems with a grade equal to to or higher than 4 will be able to recover them on the date scheduled for the recovery exam at the end of the semester.
- To participate in the recovery, the student must have been previously evaluated in a set of activities the weight of which is equivalent to a minimum of two thirds of the total grade of the subject or module.
- If after the recovery a grade of 4 or higher in the written tests of theory and problems is not achieved, the subject will be evaluated with a final grade of 4 at the most.
- Students who wish to improve their grade may take the grade improvement exam at the end of the semester, which will take place on the date scheduled for the make-up exam. Students who take the make-up exam waive the grade previously obtained in the same test.
- The make-up exam will have the same format as the previous exams.
- The review of the written tests will take place on an agreed day and place, according to the evaluation regulations of the Faculty of Biosciences.
- Students will get the grade of \"Not Evaluable\" when the evaluation activities carried out have a weight of less than 67% in the final grade.
- Students who cannot attend an individual evaluation test for justified reasons and provide the corresponding official documentation to the coordination of the degree will have the right to take the test on another day. The coordination of the degree will ensure the connection of this with the faculty of the affected subject.
- The use of artificial intelligence (AI) technologies is allowed in the preparation of assignments, provided that such use is compatible with the learning objectives of the activity and that the final work reflects a significant and personal contribution by the student in the analysis, interpretation, and critical reflection of the content. Students must explicitly declare the use of AI, specify the tools employed, identify the parts of the work in which they were used, and include a brief reflection on their contribution to both the process and the final outcome. Any use of AI that is not properly disclosed or that substantially replaces the intellectual contribution required from the student will be considered improper use of this technology and will be treated as an academic irregularity, as set out below.
- Any irregularity committed during an assessment activity, such as academic fraud, plagiarism, or improper use of AI (including failure to comply with the conditions governing the use of this technology in assignments as defined in the preceding paragraph), which may lead to a significant alteration of the grade, will result in a mark of 0 for that assessment activity. If the course guide establishes that obtaining a minimum grade in that assessment activity is an essential requirement to pass the course, or if multiple irregularities occur in assessment activities within the same course, the final grade for the course will be 0. Without prejudice to the above, disciplinary proceedings may also be initiated against any student who commits any of these irregularities.
- Any aspect that is not covered in this guide must be followed.

Bibliography

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Bartlett, John M. S.;Stirling, David; PCR Protocols eBook | 2003;

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Reiner Westermeier; Electrophoresis in Practice : A Guide to Methods and Applications of DNA and Protein Separations eBook | 2016
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-Skoog, D.A., Holler, F.J., Nieman, A Principios de Análisis Instrumental. 6ª ed. McGraw-Hill. 2008

-Harlow, E., Lane, D, Antibodies: A Laboratory Manual. Cold Spring Harbor Laboratory. New York. 1988

-Sheehan, D.,Physical biochemistry : principles and applications 2nd ed. Chichester: John Wilwy & Sons, | 2009

Direccions de interès relacionades amb diferents tècniques instrumentals:

Aula Virtual de la Autònoma Interactiva: https://cv2008.uab.cat

Biorom 2008: http://www.um.es/bbmbi/AyudasDocentes/bIOromDISCO/indices/index.html

Roolpi. Tutorial explicativo de la PCR: http://palou.uib.es/roolpi/docencia/docencia.html

University of Akron: http://ull.chemistry.uakron.edu/analytical/index.html

Software

Microsoft Word, PowerPoint, Excel.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	72	Catalan	first semester	afternoon
(PAUL) Classroom practices	721	Catalan	first semester	afternoon
(SEM) Seminars	721	Catalan	first semester	afternoon
(PAUL) Classroom practices	722	Catalan	first semester	afternoon