Integrated Laboratory Class 3

Code: 100926
ECTS Credits: 3

2024/2025

Degree	Type	Year
2500253 Biotechnology	OB	2

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Teachers

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Teaching groups languages

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

Prerequisites

It is recommended that students are simultaneously taking or have already taken the theory courses corresponding to the contents of the laboratory practices.

The student must have passed the safety and biosecurity test in the laboratories. The tests are answered in the corresponding space of the Virtual Campus and the information that must be consulted is in the space of communication of the Degree in Biotechnology. The student must be aware of the regulations of operation and security of the laboratories of the faculty of biosciences and accept that they will be fulfilled. To do so, he/she must deliver signed the certifying document/s to the teacher responsible for each module on the first day of practice before beginning.

Objectives and Contextualisation

The Integrated Laboratory 3 is the third subject of a group of 6 that are distributed over the 6 semesters corresponding to the first three years of the Degree in Biotechnology.

The training objectives of these subjects focus on the acquisition of competences within the framework of the practical training of the student.

The contents are organized in a growing order of complexity and associated to the needs and progress of the theoretical contents of the Degree.

The Integrated Laboratory 3 has as its training objectives the acquisition of practical skills in 4 specific contents:

- Probability and Statistics

- Transport phenomena

- Microbiology

- Molecular Biology and Genetics

The knowledge of probability and statistics from an applied point of view are key to being able to organize and interpret experimental data in the different areas of the Degree.

The rest of the practices in the laboratory focuses on the learning of basic specific techniques for each field and on the characteristics of the work in the laboratory.

Learning Outcomes

1. CM22 (Competence) Prioritise the instrumentation necessary for the different techniques for the separation and characterisation of biomolecules.
2. CM22 (Competence) Prioritise the instrumentation necessary for the different techniques for the separation and characterisation of biomolecules.
3. CM23 (Competence) Propose strategies for the purification of biomolecules from complex mixtures.
4. CM23 (Competence) Propose strategies for the purification of biomolecules from complex mixtures.
5. CM24 (Competence) Review the general safety standards of a biotechnology laboratory.
6. KM23 (Knowledge) Recognise the key microscopic characteristics that distinguish prokaryotic cells from eukaryotic cells, and animal cells from plant cells.
7. KM24 (Knowledge) Explain the theoretical foundation and appropriate techniques for the structural and functional characterization of proteins and nucleic acids.
8. SM20 (Skill) Use the basic techniques of manipulation, separation, detection and analysis of proteins and nucleic acids.
9. SM20 (Skill) Use the basic techniques of manipulation, separation, detection and analysis of proteins and nucleic acids.
10. SM21 (Skill) Use prokaryotic and eukaryotic cell culture techniques and techniques for the manipulation of biological systems.
11. SM21 (Skill) Use prokaryotic and eukaryotic cell culture techniques and techniques for the manipulation of biological systems.
12. SM22 (Skill) Use analytical methodologies for the assay of biological activity of cellular components.
13. SM22 (Skill) Use analytical methodologies for the assay of biological activity of cellular components.

Content

The subject is structured in 4 modules.

Probability and Statistics

Contents: They are organized in different sessions that are held in the computer room. In the successive practical sessions, data analysis will be carried out, progressively developing the following methods:

1. Descriptive statistics of one or more variables.

2. Calculation of probabilities and simulation.

3. Hypothesis tests.

Some material for establishing the analysis of variance and regression will be provided.

Transport phenomena

Contents: They are organized in several sessions that are held in the laboratory C.

1. Experimental determination of viscosities and densities.

Use of densimeters and viscometers. Determination of the density and viscosity of different aqueous solutions. Experimental observation of the dissolution and mixing heat.

2. Experimental determination of gas diffusivities.

Evaluation of the molecular diffusion of acetone in air. Comparison with theoretical values.

Microbiology

Contents: They are organized in several sessions that are held in the Biotecnology laboratory A. In these sessions we will work on different practices that will partially overlap in time and that will be complemented with additional material provided through the virtual campus.

1. Basic material and equipment for the observation, manipulation, isolation, characterization and identification of Microorganisms

2.Techniques of sterilization and preparation of culture media.
Study of sterilization techniques. Study ofthe composition and preparation of culture media. Preparation of material. Sterilization with autoclave, stove and filtration. Sterility control. Control of aseptic technique.

3. Application of basic microbiology techniques for the observation of microorganisms.
Sinks and motility. Observation of microorganisms *in vivo* with clear field microscopy. Differentiation of large groups of microorganisms. Staining techniques of prokaryotes: simple and differential stains.

4. Application of microorganism counting methods.
Determination and calculation of the number of total cells and viables of a microbial culture. Design of dilution banks and sowing with the surface-spread method.

5. Application of the basic microbiology techniques for the isolation and identification of microorganisms.
Rapid methods for isolating microorganisms. Design of enrichment and selection methods.
Obtaining pure cultures. Obtaining confluent cultures for sowing en masse and with surface-spread method.
Streaking technique. Biochemical tests and fast methods for the identification of microorganisms.

6.Ubiquity and microbial diversity.
Detecting the presence of microorganisms in all types of environments and observing their capacity for propagation and their high diversity.

Molecular Biology and Genetics

Contents: they are organized in several sessions that are held in the Biotecnology teaching laboratories. In these sessions we will work in 3 practices that will partially overlap in time.

1. Basic concepts of DNA cloning
Theaim of the practice is to present in an integrated way some of the basic stages and methodologies underlying DNA cloning, such as Genomic DNA obtention, transformation of competent *E. coli* cells, transformant selection, screening for phenotypic characteristics by replication in specific media plates, and obtaining, digestion with restriction enzymes, and plasmid DNA electrophoretic analysis.

2. Spectrophotometric DNA analysis
The UV absorption spectrum will be obtained and the concentration and purity of the analyzed DNA sample will be determined. The hyperchromic effect due to DNA denaturation will be observed.

3. Superhelicity of DNA
The action of topoisomerase I on pDNA topology will be observed. The assay in the presence of the camptothecin inhibitor will reveal the mechanism of the enzymatic activity.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Microbiology	12	0.48	CM22, CM23, CM24, KM23, SM20, SM21
Molecular Biology and Genetics	17	0.68	CM22, CM23, CM24, KM24
Probability and statistics	13	0.52	SM22, SM22
Transport Phenomena	15	0.6	CM22, CM24, SM21
Type: Autonomous			
Report writing and questionnaires resolution	12	0.48	KM24, SM20, SM21, SM22
Studying	6	0.24	CM22, CM23, KM23, KM24

The attendance to the lessons of this subject is mandatory since they imply an acquisition of competitions based on the practical work.

In order to be able to attend the experimental practices, the student must justify having passed the biosafety and security tests that he will find in the Virtual Campus and he/she will have to know and accept the rules of operation of the laboratories of the Faculty of Biosciences. Therefore, the signed document/s will be delivered to the corresponding coordinator of each module on the first day of the practices.

There are 3 practice groups programmed for the Probability and Statistics module and 4 groups for the rest. The distribution of the groups can be consulted in the virtual Campus in the communication area of the Degree in Biotechnology.

Probability and Statistics

Classes in the computer rooms that include the delivery of the statements of the practices, the presentation of the teacher and the realization of the practice.

A document with the program of the lessons will be published in advance to the Virtual Campus.

Transport phenomena, Microbiology, Molecular Genetics and Biology

Practical classes of laboratory and data analysis. The students perform the experimental work under the supervision of the professor/s responsible for each session.

The practice protocols and, if applicable, the questionnaires for response, will be available on the Virtual Campus of the subject.

Before beginning a practical session the student must have read the protocol and know therefore theobjectives ofthe practice, the foundations and the procedures that must be carried out. If so, you must also know the specific safety and waste treatment measures. To attend module of microbiology, it is necessary for the student to justify having passed the safety and biosecurity tests that will be found in the Virtual Campus. In addition, they must comply with the regulations to work in a Microbiology laboratory that they will find indicated in the corresponding protocol.

In the practical sessions you must bring:

- Protocol and, if applicable, the questionnaire.

- A notebook to collect the information of the experimental work.

- Lab coat.

- Safety glasses.

- Permanent marker.

- Mask

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Microbiology: Continous evaluation	10%	0	0	CM23, CM24, KM23, SM20, SM21, SM22
Microbiology: Individual written exam	10%	0	0	CM23, KM24
Molecular Biology and Genetics: Continuous assessment	2,5%	0	0	CM22, CM23, CM24, KM24, SM20, SM21, SM22
Molecular Biology and Genetics: Examination	22,5%	0	0	CM23, KM24
Probability and statistics: continous evaluation	15%	0	0	SM22
Transport phenomena: Written report in groups	20%	0	0	CM22, CM24, SM21
Transport phenomena:Continous evaluation	5%	0	0	CM22, CM24, SM21

Important notes to take into account

- Attendance to practical sessions (or field trips) is mandatory. Students missing more than 20% of programmed sessions will be graded as "No Avaluable"

- To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

Evaluation system of the different parts of the subject

Probability and Statistics

The evaluation system consists of a single component:

1 Continuous assessment of the work: Resolution of the questionnaires filled by the students at the end of some practical sessions.

Transport phenomena

The evaluation system is organized in two parts, each one of which will be assigned a specific weight in the final grade:

1 Continuous assessment of group work: the practical ability of each group of students will be evaluated daily (self-evaluation, consistent and inconsistent elements analysis, data treatment during the practical sessions). Skills: E8, T1, T2, T5, T9, T11, T12

2 Evaluation of the work reflected in a written report of the practical results of each laboratory (practices of diffusivity and viscosity/density), which will be given to the teaching staff at the end of the practices. Skills: E8, T1, T2, T5, T9, T11, T12.

These tests will have the following weights: Work in the laboratory and attitude 2 points; Written report: Viscosity and density 4 points,diffusivity 4 points, respectively on a total of 10.

Microbiology

The evaluation system is organized in two parts:

1 Continuous evaluation of group work: the practical ability of each group of students will be evaluated daily, which will consist of the delivery of different practical results to the teaching staff obtained each laboratory session. Skills: E3, E16, T1, T2, T5, T11, T12.

2 Individual assessment of the contents (written test module): a written test will be performed (see time table), which will consist of 20 test questions about the work done in the laboratory and about the additional material on the virtual campus . Skills: E3, T1, T2, T5, T11, T12

These tests will have a weight of 4 and 6 points, over 10, respectively.

Biology and Molecular Genetics

This module will be evaluated by means of an individual exam in which questions and exercises related to the practices carried out will have to be solved. The exam will take place after the practice sessions of the four groups (see calendar). The weight of the exam on the final mark of the module will be 50%. The other 50% will come from work and attitude during the practice (continuous evaluation).

The final evaluation of the subject will be obtained from the weighted average of the evaluation of the four modules that the subject consists of.

To pass the subject, at least 80% of theprogrammed sessions must be at least equal to or greater than 5 and obtain a minimum grade of 4 in each group of contents. Students whodo not achieve the minimum qualification of 4 in one or more of the groups of contents will receive a maximum final grade of the subject of 4 points.

Other aspects:

- A student will obtain the non-evaluable qualification when he has attended less than 50% of the programmed sessions of a module.

- The repeating students will only have to perform and be evaluated of the contents of the modules that had not been passed in the first enrollment (<4). For the contents of the modules passed, the note will be kept for a maximum period of three additional tuition placements.

- Plagiarism: Notwithstanding other disciplinary measures that are deemed appropriate, andin accordance with the current academic regulations, the irregularities committed by the student who can lead to a variation of the qualification of a Act of evaluation. Therefore, copying or copying a test, exercise or practice or any other evaluation activity will involve suspending it with a zero, and if it is necessary to pass the subject, the entire subject will be failed. Qualified assessment activities will not be recovered in this way and by this procedure, and therefore the subject will be failed directly without opportunity to recover it in the same academic year.

This subject/module does not provide for the single assessment system

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Molecular Biology and Genetics

- Molecular Biology Techniques: A Classroom Laboratory. Fourth Edition (2019)

Sue Carson, Heather Miller, Melissa C. Srougi, D. Scott Witherow. Academic Press Ed.

Software

Probability and Statistics

- R and R-Studio

Transport Phenomena, Microbiology, Molecular Biology and Genetics

There is not specific software

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	421	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	422	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	423	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	424	Catalan	first semester	morning-mixed