



Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1100307 **Name:** Advanced Instrumental Techniques

Credits: 6,00 **ECTS Year:** 3 **Semester:** 1

Module: Quantitative Instrumental Techniques and Molecular Systems Biology

Subject Matter: Instrumental techniques in Biotechnology **Type:** Compulsory

Department: Biotechnology

Type of learning: Classroom-based learning

Languages in which it is taught: English, Spanish

Lecturer/-s:

| | | |
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Lecturer**)

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Module organization

Quantitative Instrumental Techniques and Molecular Systems Biology

| Subject Matter | ECTS | Subject | ECTS | Year/semester |
|--|-------|----------------------------------|------|---------------|
| Instrumental techniques in Biotechnology | 12,00 | Advanced Instrumental Techniques | 6,00 | 3/1 |
| | | Basic Instrumental Techniques | 6,00 | 2/1 |
| Molecular Systems Biology | 12,00 | Genomics | 6,00 | 4/1 |
| | | Proteomics | 6,00 | 4/1 |

Recommended knowledge

Prerequisites: students must have a minimum level of B2 in English or equivalent. It is recommended to have studied Molecular Genetics.



Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

- R1 The student has understood and assimilated the contents of the subject.
- R2 The student is able to solve problems or case studies related to the subject contents, by using different resources (bibliographic, IT, etc.)
- R3 The student is able to work in a laboratory, carrying out basic operations correctly and taking into account the corresponding safety standards. He/she understands the planning, development and purpose of the experience, and is able to contrast and validate the obtained results.
- R4 The student is able to write an intelligible and organized text on different aspects of the subject.
- R5 The student is able to present and defend his/her work adequately.
- R6 The student seeks bibliographic information from different sources and can analyze it with a critical and constructive spirit.
- R7 The student collaborates with the teacher and his/her peers throughout the learning process; he/she works in a team; treats everyone with respects, is proactive and fulfills the organization rules of the course.



Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

| BASIC | | Weighting | | | |
|----------|---|-----------|---|---|---|
| | | 1 | 2 | 3 | 4 |
| CB1 | Students acquire and understand knowledge in their field of study based on general secondary education but usually reaching a level that, although supported on advanced text books, also includes aspects involving state-of-the-art knowledge specific to their area. | | | | X |
| CB2 | Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study. | | | X | |
| CB3 | Students are able to collect and interpret relevant data (generally in their field of study) and give opinions that involve reflection on relevant social, scientific or ethical issues. | | | | X |
| CB4 | Students can communicate information, ideas, problems and solutions to a specialized or non-specialized audience. | | | | X |
| CB5 | Students develop the necessary learning skills to undertake further studies with a high level of autonomy. | | X | | |
| GENERAL | | Weighting | | | |
| | | 1 | 2 | 3 | 4 |
| CG01 | Capacity to analyze and synthesize. | | | | X |
| SPECIFIC | | Weighting | | | |
| | | 1 | 2 | 3 | 4 |
| CE22 | Knowing and understanding contents, principles and theories related to biotechnology. | | | X | |



| | | | | | |
|------|---|---|--|---|---|
| CE23 | Knowing how to use laboratory equipment and to carry out basic operations for each discipline including: safety measures, handling, waste disposal and activity register. | | | | X |
| CE24 | Knowing basic and instrument laboratory techniques in the different areas of biotechnology. | | | | X |
| CE25 | Knowing how to analyze and understand scientific data related to biotechnology. | | | X | |
| CE27 | Knowing and applying action plans and assessment criteria of biotechnology processes. | X | | | |
| CE28 | Integrating life science and Engineering into processes of development of biotechnological products and applications. | X | | | |
| CE29 | Contrasting and checking results of biotechnological experimentation. | | | | X |
| CE30 | Solving and analyzing problems posed by biotechnology. | | | | X |
| CE31 | Describing and calculating important variables of processes and experiments. | | | | X |
| CE32 | Knowing how to use different specific operating systems and software packages designed for Biotechnology. | | | X | |
| CE33 | Knowing and complying with legislation and ethics of biotechnological processes and applications. | X | | | |
| CE34 | Knowing main characteristics of Molecular biosciences and biotechnology communication. | | | X | |

| TRANSVERSAL | | Weighting | | | |
|-------------|---|-----------|---|---|---|
| | | 1 | 2 | 3 | 4 |
| CT02 | Capacity to organize and plan. | | | X | |
| CT03 | Mastering Spanish oral and written communication. | | | | X |
| CT04 | Command of a foreign language (English) | | | | X |
| CT05 | Knowing and applying Basic ITC skills related to Biotechnology. | | | | X |
| CT06 | Capacity to manage information (capacity to look for and analyze information coming from different types of sources). | | | | X |



| | | | | |
|------|---|---|---|---|
| CT07 | Problem solving. | | | X |
| CT09 | Capacity to work in interdisciplinary and multidisciplinary team. | X | | |
| CT10 | Interpersonal skills. | X | | |
| CT12 | Critical and self-critical capacity. | | | X |
| CT13 | Ethics. | | | X |
| CT14 | Capacity to learn | | | X |
| CT16 | Capacity to produce new ideas (creativity) | X | | |
| CT19 | Capacity to apply theoretical knowledge | | X | |
| CT20 | Research skills | | X | |
| CT21 | Sensitivity to environmental issues | X | | |



Assessment system for the acquisition of competencies and grading system

| Assessed learning outcomes | Granted percentage | Assessment method |
|----------------------------|--------------------|------------------------------------|
| R1, R2, R3, R4, R5, R7 | 50,00% | Written test |
| R1, R2, R4, R5, R6, R7 | 20,00% | Submission of papers |
| R1, R2, R3, R4, R5, R6, R7 | 20,00% | Laboratory test |
| R1, R2, R4, R5, R6, R7 | 10,00% | Solving problems with the computer |

Observations

This course is not eligible for single evaluation. According to the general evaluation and qualification regulations, the preferred evaluation system will be continuous evaluation. At the end of each chapter, a self-assessment test will be taken. The test will consist of a multiple-choice questionnaire, or similar, to be carried out in the classroom. It will provide instructions and response feedback.

In order to average the student must individually pass the Written test and the Lab test (5/10).

Online turn-in tasks will only be graded for students attending the corresponding sessions.

Attendance at laboratory work is mandatory to pass the subject. The written test will include theoretical knowledge of laboratory work.

Attendance to computer-based problem sessions is mandatory

*The use of artificial intelligence (AI)-based tools is subject to the discretion of the teacher, who may establish specific limits or conditions depending on the training or assessment activity.



MENTION OF DISTINCTION:

In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with 9 Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

- M1 Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.
- M2 Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.
- M3 Activities carried out in spaces with specialized equipment.
- M4 Supervised monographic sessions with shared participation..
- M6 Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.
- M7 Set of oral and/or written tests used in initial, formative or additive assessment of the student
- M8 Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical , practical and/or small-group tutoring sessions. Work done on the university e-learning.



- M9 Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform.

IN-CLASS LEARNING ACTIVITIES

| | LEARNING OUTCOMES | HOURS | ECTS |
|-------------------------|----------------------------|--------------|-------------|
| ON-CAMPUS CLASS M1 | R1, R2, R4, R5, R6, R7 | 30,00 | 1,20 |
| PRACTICAL CLASSES M2 | R1, R2, R5, R6, R7 | 9,00 | 0,36 |
| LABORATORY M3 | R1, R3, R4, R6, R7 | 12,00 | 0,48 |
| SEMINAR M4 | R1, R2, R6, R7 | 6,00 | 0,24 |
| TUTORIAL M6 | R1, R6 | 1,50 | 0,06 |
| ASSESSMENT M7 | R1, R2, R3, R4, R5, R6, R7 | 1,50 | 0,06 |
| TOTAL | | 60,00 | 2,40 |

LEARNING ACTIVITIES OF AUTONOMOUS WORK

| | LEARNING OUTCOMES | HOURS | ECTS |
|----------------------------------|------------------------|--------------|-------------|
| AUTONOMOUS GROUP WORK M8 | R1, R2, R3, R4, R6, R7 | 18,00 | 0,72 |
| AUTONOMOUS INDIVIDUAL WORK M9 | R1, R2, R3, R4, R5, R6 | 72,00 | 2,88 |
| TOTAL | | 90,00 | 3,60 |



Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

| Content block | Contents |
|--|--|
| Teaching Unit 1: FUNDAMENTALS AND APPLICATIONS OF ADVANCED INSTRUMENTAL TECHNIQUES | <ol style="list-style-type: none">1.Obtaining samples in research. Introduction to sample collections: Biobanks. Sampling techniques.2.Cell fractionation techniques: filtration, differential centrifugation, ultracentrifugation, etc.3.Nucleic acid determination methods: isolation, quantification, purity and integrity.4.Hybridization-based nucleic acid analysis techniques: Southern & Northern blot as a precursor to microarrays.5.EMSA (Electromobility Shift Assays).6.In vitro footprinting analysis & In vivo DNA footprinting or Ligation-mediated PCR (LMPCR).7.Yeast one-hybrid assay.8.ChIP (Chromatin immunoprecipitation).9.Amplification and quantification of nucleic acids: PCR; RT-PCR (retrotranscription followed by PCR amplification); microRNAs.10.Design of primers to amplify nucleic acid sequences.11.Design of primers to subclone fluorescently tagged proteins (GFP).12.Phage display as an approach for identification of therapeutic peptides and mapping of protein interaction domains.13.Overexpression and gene silencing as approaches to study gene function using AS oligos and lentivirus systems.14.Overexpression and gene silencing by knock out and knock in methods. |
| Teaching unit 2: LABORATORY WORK IN ADVANCED INSTRUMENTAL TECHNIQUES | <ol style="list-style-type: none">1.Continuous and discontinuous polyacrylamide gels for the study of proteins2.Purification of recombinant proteins by affinity chromatography |



Organization of the practical activities:

| | Content | Place | Hours |
|------|--|--------------|-------|
| PR1. | Continuous and discontinuous polyacrylamide gels for the study of proteins | Laboratory | 2,00 |
| PR2. | Purification of recombinant proteins by affinity chromatography | Laboratory | 10,00 |
| PR3. | Primer and probe design | Lecture room | 9,00 |

Temporary organization of learning:

| Block of content | Number of sessions | Hours |
|--|--------------------|-------|
| Teaching Unit 1: FUNDAMENTALS AND APPLICATIONS OF ADVANCED INSTRUMENTAL TECHNIQUES | 24,00 | 48,00 |
| Teaching unit 2: LABORATORY WORK IN ADVANCED INSTRUMENTAL TECHNIQUES | 6,00 | 12,00 |



References

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- SAMBROOK R. Molecular Cloning: a Laboratory Manual, Cold Spring Harbor Laboratory.
- Mülhardt C. Molecular biology and Genomics; Elsevier Inc; 2007
- Nicholl, DT. An Introduction to Genetic Engineering. 3rd edition. Cambridge University Press; 2008
- Baker, K. At the bench: A Laboratory Navigator. Cold Spring Harbour Laboratory Press; 1998.
- Molecular Biology Problem Solver: A Laboratory Guide. Edited by Alan S. Gerstein Copyright ©2001 by Wiley-Liss, Inc. ISBNs: 0-471-37972-7 (Paper); 0-471-22390-5 (Electronic).
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