Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1100208 **Name:** Basic Instrumental Techniques

Credits: 6,00 **ECTS Year:** 2 **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: Spanish

Lecturer/-s:

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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

General Chemistry Organic Chemistry Biochemistry

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	
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	60,00%	Written test
R3, R4, R5, R6, R7	20,00%	Submission of papers
R2, R4	20,00%	Laboratory test

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.
"During the development of the subject, a continuous evaluation of the student will be carried out using different evaluation tools and techniques in order to be able to personally rate the student 's evaluation of the knowledge acquired."
The complete written test consists of a written test of theoretical content and a written test of practical content (problem solving). You need to get aminimum of 4.0 out of 10 in each one of them to average. You also need to score a minimum of 4.0 out of 10 on the Lab Test to average. Attendance at laboratory practices is mandatory to pass the course. A lack of attendance at practices is only allowed as long as it is duly justified. The submission of papers includes a collaborative work in the classroom using spectroscopic and chromatographic techniques (20%). Each of the questionnaires, practice worksheets and papers submitted after the deadline will be penalized with a maximum weighting of 5 points out of a total of 10.

*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, R6	30,00	1,20
PRACTICAL CLASSES M2	R1, R3, R4, R5, R6	9,00	0,36
LABORATORY M3	R2, R7	12,00	0,48
SEMINAR M4	R1, R6	6,00	0,24
TUTORIAL M6	R4, R6, R7	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, R5, R6, R7	18,00	0,72
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, 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
Unit 1. CHROMATOGRAPHY	1. CHROMATOGRAPHY1.1 SEPARATION AND ANALYSIS TECHNIQUES1.2. LIQUID CHROMATOGRAPHY1.2.1. Thin Layer Chromatography (TLC) and Column Chromatography1.2.2 Ion Exchange Chromatography1.2.3 Size Exclusion Chromatography1.2.4 Electrophoresis1.2.5 High-efficiency liquid chromatography (HPLC) Ion chromatography1.3. GAS CHROMATOGRAPHY1.3.1 INSTRUMENTATION: Carrier gases, injection system, columns, influence of temperature, types of solid supports Stationary phases in CGL, detectors: classification and sensitivity1.3.2 Coupled techniques1.3.3 Qualitative analysis. Retention times. Homologous series. Kovats indexes.1.3.4 Indirect determinations by GC1.3.5 Quantitative analysis. Applications

Teaching unit 2: SPECTROSCOPY	2.1. MASS SPECTROSCOPY2.1.1 Introduction2.1.2. Meta-stable ions2.1.3. EM-IE2.1.4. Abundance of ions2.1.5. Molecular ion2.1.6. Fragmentations2.1.7. Fragmentation rules2.1.8 Structural elucidating with GM spectra2.2 INFRARED SPECTROSCOPY2.2.1 Fundamentals. Types of vibrations2.2.2 Characteristic absorption frequencies of different bonds in organic compounds2.2.3 Instrumentation2.2.4 Structural elucidation with IR spectra2.2.5 Applications2.3 NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY2.3.1. Physical fundamentals of NMR spectroscopy.2.3.2 The nuclear magnetic resonance spectrometer.2.3.3. 1H nuclear magnetic resonance. Shielding or magnetic protection by electrons.2.3.4. 1H NMR spectrum.2.3.4.1. Integration curves.2.3.4.2 Spin-spin decoupling.2.3.4.3. Coupling constants.2.3.5 Interpretation of 1H nuclear magnetic resonance spectra.2.3.6. 13C nuclear magnetic resonance spectroscopy 2.3.7 Structural elucidation with spectra 1HRMN and 13CRMN
Teaching unit 3: STRUCTURAL ELUCIDATION	Structural Elucidation of a compound from its GM, IR, 1HRMN and 13CRMN spectra
Teaching Unit 4: BASICS OF OTHER INSTRUMENTAL TECHNIQUES	4.1 UV-Visible SPECTROSCOPY4.1.1 Physical Fundamentals of NMR Spectroscopy4.1.2The UV spectrometer4.2 Luminescence and fluorescence4.2.1 Physical foundations.4.3. Atomic Spectroscopy4.3.1 Physical foundations4.3.2 The atomic absorption spectrometer4.4. RX Spectroscopy4.4.1 Physical fundamentals4.4.2 RX equipment
Teaching Unit 5: LABORATORY AND PRACTICAL CLASSES	Separation of amino acids by thin layer chromatography.UV-visible spectroscopy. Obtaining spectra and quantitative analysis.Resolution of mixtures by spectroscopy.Potentiometric titration of an acid.Flow injection analysisTest evaluation workshop Labster Problem resolution

Organization of the practical activities:

	Content	Place	Hours
PR1.	Separation of amino acids by thin layer chromatography.	Laboratory	2,00
PR2.	UV-visible spectroscopy. Obtaining spectra and quantitative analysis.	Laboratory	2,00
PR3.	Resolution of mixtures by spectroscopy.	Laboratory	2,00
PR4.	Potentiometric titration of an acid.	Laboratory	2,00
PR5.	Flow injection analysis	Laboratory	2,00
PR6.	Test evaluation workshop	Laboratory	2,00
PR7.	Labster	Drylab	2,00
PR8.	Problem resolution	Lecture room	7,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
Unit 1. CHROMATOGRAPHY	5,00	10,00
Teaching unit 2: SPECTROSCOPY	5,00	10,00
Teaching unit 3: STRUCTURAL ELUCIDATION	5,00	10,00
Teaching Unit 4: BASICS OF OTHER INSTRUMENTAL TECHNIQUES	4,50	9,00
Teaching Unit 5: LABORATORY AND PRACTICAL CLASSES	10,50	21,00

References

Skoog, D.A., Holler, F.J., Nieman, T.A., Principios de Análisis Instrumental, 5ª ed. McGraw Hill, Madrid, 2001.
-Christian Gary D., Química Analítica, 6ª ed. McGraw Hill, Mexico, 2010
-Skoog, D.A., West, D.M., Holler, F.J. Crouch, S.R., Fundamentos de Química Analítica, 8ª ed., Editorial Thomson, 2005.
-Harris, D.C., Anàlisi Química Quantitativa, 1ª ed., Editorial Reverté, 2006.
- Rubinson, K.A., Rubinson, J.F., Análisis Instrumental, Pearson Educación, S.A., Madrid, 2001.

BIBLIOGRAPHY FOR PRACTICES
-Kolthoff, I.M., Sandell, E.B., Meehan, E.J., Bruckenstein, I., Análisis Químico Cuantitativo, 4ª Ed., Editorial Nigar, 1976.
-Vogel, A.I., Vogel's Textbook of Quantitative Chemical Analysis, 5th Ed., Editorial Longman, 1989