



IDENTIFYING DATA

Enhancement of Analytical Chemistry

Subject	Enhancement of Analytical Chemistry			
Code	V11G201V01406			
Study programme	Grado en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Lavilla Beltrán, María Isela			
Lecturers	Lavilla Beltrán, María Isela			
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General description	This subject provides students with knowledge about important and current aspects of analytical chemistry (e.g., bioanalytical techniques, automation and miniaturisation, sensors and chemometrics). Students will be able to complete their training and integrate the knowledge acquired in analytical chemistry, which will allow them to address problem-solving in areas of special interest (e.g., clinical, environmental and industrial fields).			

Training and Learning Results

Code				
A1	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
B4	Ability for analysis and synthesis			
C30	Ability to understand, interpret and adapt the advances in the field of Analytical Chemistry			
D1	Ability to solve problems			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Recognize the main current trends in analytical chemistry.		B4	C30	
Use and recognize different bioanalytical methodologies.	A1		C30	
Describe and distinguish the different types of automatic analysis systems.		B4	C30	
Understand the advantages and limitations of automation.	A3	B4	C30	
To train students in the development of miniaturized analytical tools and their application.	A1		C30	
Value the importance of the use of sensors to obtain fast and reliable analytical information.	A3		C30	
Correctly apply different chemometric techniques to solve analytical problems.	A1 A3		C30	D1
Acquire skills to approach an analytical problem in all its stages (from the selection of an appropriate analytical methodology, through the practical laboratory work, to the interpretation of results).	A1 A3	B4	C30	D1

Contents

Topic				
Topic 1. Immunoassay	Introduction. In vitro antigen-antibody reaction. Immunoassay techniques without marker. Immunoassay techniques with marker: generalities. Radioimmunoassay. Enzyme immunoassay. Fluoroimmunoassay. Luminoimmunoassay.			

Topic 2. Enzymatic methods of analysis	Introduction. Enzymatic end-point methods: single-step methods and methods with coupled reactions. Enzyme kinetic methods: methods based on zero-order kinetics and methods based on one-order kinetics.
Topic 3. Determination of nucleic acids: Hybridization and PCR techniques	Introduction. Nucleic acid extraction and purification techniques. Hybridization assays: liquid phase, solid phase and in situ. Polymerase chain reaction: basics. Variants of classical PCR.
Topic 4. Automation and miniaturization	Introduction. Automation: generalities. Analyzers. Flow Injection Analysis (FIA). Sequential injection analysis (SIA). Miniaturization: fundamentals and approaches.
Topic 5. Chemical sensors and biosensors	Introduction. Recognition systems. Classification of chemical sensors and biosensors. Analytical characteristics of the sensors. Applications of interest.
Topic 6. Chemometrics	Introduction to chemometrics. Structure of hypothesis testing. Rejection of anomalous results. Comparison of analytical results: parametric and non-parametric tests. Control charts. Introduction to experimental design.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24	36	60
Seminars	12	24	36
Laboratory practical	14	10	24
Objective questions exam	2	10	12
Objective questions exam	0	18	18

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The lecturer will develop the contents of the programme based on the material provided to the student through Moovi. In the lecture sessions, the lecturer will present the fundamental aspects of the subject, which should be complemented by the recommended bibliography.
Seminars	The seminar classes will help to reinforce the learning of the subject matter explained during the lectures by solving numerical problems and/or theoretical-practical exercises. The lecturer will regularly propose different problems, exercises or questionnaires that will be solved individually by the student and delivered for evaluation.
Laboratory practical	Laboratory experiments will be carried out in 4 sessions of 3.5 hours each. Prior to each practical session, the student will be provided with supporting material in Moovi for the preparation of the experiments to be carried out.

Personalized assistance

Methodologies	Description
Lecturing	The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used.
Seminars	The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used.
Laboratory practical	The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used.
Tests	Description
Objective questions exam	The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used.
Objective questions exam	The lecturer will resolve doubts in a personalised manner on any of the proposed activities (lectures, seminars, laboratory practicals and exams). For this purpose, the tutoring hours of the teaching staff will be used.

Assessment

Description	Qualification	Training and Learning Results
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Seminars	For the evaluation of this activity, the teacher will propose the resolution and delivery by the student of some problems, exercises and/or questionnaires in seminar classes.	5	A1 A3	B4	C30	D1
Laboratory practical	The teacher will assess the experimental work carried out by the student in the laboratory sessions through observation and the delivery of the obtained results (laboratory report).	15	A1 A3	B4	C30	D1
	Attendance at laboratory sessions is compulsory. Absence from any laboratory session must be duly justified.					
Objective questions exam	There will be a first examination limited to approximately half of the subject.	40	A1 A3	B4	C30	D1
	This exam may consist of short answer questions, problems and multiple choice questions.					
	The fact of sitting the exam precludes the student from the grade "Not presented".					
	Students who obtain a minimum score of 5 out of 10 will not be examined again in the contents considered in the first examination.					
Objective questions exam	This final exam is compulsory.	40	A1 A3	B4	C30	D1
	Students who have passed the first part will take the second part of the syllabus.					
	This examination may consist of short answer questions, problems and/or multiple-choice questions.					
	The fact of sitting the exam precludes the student from the grade "Not presented".					
	Students who have not passed the first part will have to take the first part of the syllabus (40% final mark).					

Other comments on the Evaluation

Second opportunity (July):

The marks obtained by the student during the course in the laboratory practicals and seminars will be retained (20 % of the grade).

Students will be able may do both exams.

The student who wishes may opt for the overall assessment.

Sources of information

Basic Bibliography

Paolo Ugo, Pietro Marafini, Marta Meneghello, **Bioanalytical chemistry. From biomolecular recognition to nanobiosensing**, Primera, De Gruyter, 2021

Miguel Valcárcel, Soledad Cárdenas, **Automatización y miniaturización en Química Analítica**, Primera, Springer, 2000

Florinel-Gabriel Bănică, **Chemical sensors and biosensors: Fundamentals and applications**, Primera, Wiley, 2012

Guillermo Ramis Ramos, María Celia García Álvarez-Coque, **Quimiometría**, Prmera, Síntesis, 2001

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Quality in Analytical Labs/V11G201V01407

Food, Agricultural and Environmental Analytical Chemistry/V11G201V01410

Subjects that it is recommended to have taken before

Biochemistry/V11G201V01201

Analytical Chemistry I: Principles of Analytical Chemistry/V11G201V01202

Analytical Chemistry II: Optical Methods of Analysis/V11G201V01207

Analytical Chemistry III: Electroanalytical Methods and Separations/V11G201V01302

Analytical Chemistry IV: Chromatographic and Affine Methods/V11G201V01306

