



IDENTIFYING DATA

Instrumental analysis

Subject	Instrumental analysis			
Code	O01G261V01403			
Study programme	Grado en Ciencias Ambientales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish French Galician English			
Department				
Coordinator	Falqué López, Elena			
Lecturers	Falqué López, Elena			
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Web				
General description	In this subject, the student will know the foundations of those instrumental technicians of greater use and applicability in the analysis and environmental control.			

Training and Learning Results

Code				
A3	Students will be able to gather and interpret relevant data (normally within their field of study) that will allow them to have a reflection-based considered opinion on important issues of social, scientific and ethical nature.			
A4	Students will be able to present information, ideas, problems and solutions both to specialist and non-specialist audiences.			
B1	Students will acquire analysis, synthesis and information-management skills to be applied in the food and agriculture and environmental sectors			
B2	Students will acquire and apply teamwork abilities and skills.			
C1	To know the physical, chemical and biological foundations linked with the environment and its technological processes			
C4	Ability to integrate the experimental data found in field and/or lab work with theoretical knowledge.			
C5	Ability to interpret data from quantitative and qualitative perspectives.			
D1	Capacity of analysis, organization and planning.			
D3	COral and written communication in the native language and foreign			
D4	Ability of autonomous learning and information management.			
D5	Ability of problem solving and decision making			
D9	Team of interdisciplinary nature			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Comprise the foundation of the distinct instrumental spectroscopic, electrochemical and chromatographic techniques employees for the analysis and control of quality of the foods, and food and environmental products.	A3	B1	C1	D1
	A4	B2	C4	D3
			C5	D4
				D5
				D9
Know and identify the characteristics that owe to gather the analites to select the most adapted techniques for his analysis.	A3	B1	C1	D1
	A4	B2	C4	D3
			C5	D4
				D5
				D9

Be able to select and apply the analytical techniques more adapted for the analysis of the foods (raw matters, foods elaborated and environmental products) to determine his characteristics and like this can evaluate and control the food and environmental quality.	A3	B1	C1	D1
	A4	B2	C4	D3
			C5	D4
				D5
				D9
Treat, evaluate and interpret the results obtained in the determinations and train to the student so that it take consciousness of the social responsibility of his reports and his repercussion in the taking of decisions.	A3	B1	C1	D1
	A4	B2	C4	D3
			C5	D4
				D5
				D9

Contents

Topic

DIDACTIC UNIT I. Introduction to the Instrumental Analysis and to the Analytical Process. SUBJECT 1. Introduction to the instrumental methods of analysis.

DIDACTIC UNIT II: Optical Methods.

SUBJECT 2. Optical methods: Generalities.
SUBJECT 3. Spectroscopy of molecular absorption UV-vis.
SUBJECT 4. Spectroscopy of molecular luminescence.
SUBJECT 5. Atomic spectroscopy.

DIDACTIC UNIT III: Electrochemical Methods.

SUBJECT 6. Electrochemical methods: Generalities.
SUBJECT 7. Electrodes.
SUBJECT 8. Potentiometry.

DIDACTIC UNIT IV: Chromatographic Methods.

SUBJECT 9. Chromatography: Generalities.
SUBJECT 10. Paper and thin layer chromatography.
SUBJECT 11. High resolution liquid chromatography.
SUBJECT 12. Gas chromatography.

DIDACTIC UNIT V: Other instrumental techniques. SUBJECT 13. Other instrumental technique. Hyphenated techniques.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	42	70
Seminars	14	21	35
Laboratory practical	14	0	14
Mentored work	0	14	14
Problem and/or exercise solving	0	1	1
Report of practices, practicum and external practices	0	14	14
Essay questions exam	0	2	2

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

Methodologies

	Description
Lecturing	Exhibition by part of the professor, or of the student in his case, of the most important appearances of the contents of the subjects of the course, theoretical bases and/or guidelines of a work, exercise or project to develop by the student.
Seminars	Activities focused to the work on a specific subject, to proposal of the professor or of the student, that allow to deepen or complement the contents of the matter.
Laboratory practical	Activities, in groups of 2 or 3 people, in which it will ascertain the direct application of the theoretical knowledges developed in the master sessions and seminars.
Mentored work	The student, of individual way or in group, elaborates a document on an appearance or concrete subject of the course, by what will suppose the research and collected of information, reading and handle of bibliography, editorial, exhibition...

Personalized assistance

Methodologies	Description
Laboratory practical	To the start of each session of laboratory, the professor will do an exhibition of the contents to develop by the students. Likewise, during the development of the practices of laboratory, the student has to elaborate a fascicle of laboratory where collect all the relative observations to the experiment realised, as well as the data and results obtained. The student will have by anticipated, in the platform tem@, of the material employed in classes (so much theoretical, bulletins of problems, like scripts of the practices of laboratory).

Mentored work	In the sessions of resolution of problems and exercises, the professor will indicate the guidelines or routines for the resolution of the same. In the tutored works, will value the final document, and in his case also the exhibition of the same, on the thematic, conference, summary of reading, investigation or memory developed. The student will have by anticipated, in the Moovi platform, of the material employed in classes (so much theoretical, bulletins of problems, like scripts of the practices of laboratory).
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Tests	Description
Report of practices, practicum and external practices	The student will have to elaborate a report of the practices realised in the laboratory where collect all the relative observations to the experiments realised, the data obtained and the calculation of the results, as well as the discussion of the same. The student will have by anticipated, in the Moovi platform, of the material employed in classes (so much theoretical, bulletins of problems, like scripts of the practices of laboratory).

Assessment							
	Description	Qualification	Training and Learning Results				
Seminars	The assistance and participation in seminars will suppose until 10% of the final note, that will include the assistance, attitude, participation and results obtained in the seminars. With this methodology evaluate all the results of learning.	10	A3 A4	B1 B2	C1 C4 C5	D1 D3 D4 D5 D9	
Laboratory practical	The practices of laboratory will value between -1.5 and +1.5 point and will suppose until 15% of the final note, that includes the forcing of attend to all the sessions, the realisation of all the practices and the preparation and delivery of the memory of practices. Also will take into account the attitude and participation of the student in the laboratory. This part will have to be surpassed independently of the other to be able to surpass the course and be in conditions to add the assessment of the other activities. With this methodology evaluate all the results of learning.	15	A3 A4	B1 B2	C1 C4 C5	D1 D3 D4 D5 D9	
Mentored work	The participation, attitude, as well as the work in himself (form to tackle the concepts to work, editorial, presentation...Of the document written and exhibition, to be the case) will suppose until 5% of the final note. With this methodology evaluate all the results of learning.	5	A3 A4	B1 B2	C1 C4 C5	D1 D3 D4 D5 D9	
Problem and/or exercise solving	There will be a Partial (problems related to topics 1 to 5, inclusive) and/or a 2nd Partial or Final Exam. It is necessary to obtain, at least, a 5 (out of 10). With this methodology all the learning results are evaluated.	35	A3 A4	B1 B2	C1 C4 C5	D1 D3 D4 D5 D9	
Essay questions exam	There will be a Partial (topics 1 to 5, inclusive) and a 2nd Partial or Final Exam. It is necessary to obtain, at least, a 5 (out of 10). In the 2nd Partial and/or in the Final, a minimum score must be obtained in each of the Didactic Units. With this methodology all the learning results are evaluated.	35	A3 A4	B1 B2	C1 C4 C5	D1 D3 D4 D5 D9	

Other comments on the Evaluation

ANNOUNCEMENTS 1st and 2nd Opportunity

There are two evaluation modalities (Continuous and Global), being the Continuous Evaluation the preferred one. Students who wish the Global Evaluation (100% of the grade in the official exam) must communicate it to the teacher, by e-mail, within a period not exceeding one month from the beginning of the teaching of the subject.

• Continuous Evaluation Mode.

It implies the attendance and accomplishment of all the described methodologies: theory exam (35%), problems exam (35%), laboratory practices (15%), tutored work (5%) and seminars (10%).

There will be 2 exams: First Partial (theory and problems) with eliminating character of subject and on a date to be agreed among all, and the 2nd Partial on the official date of the exam. Those who do not pass the first midterm will have to go to the official date and examine both midterms. Both the Midterm and Final exams will have a maximum duration of four hours with a break between theory and problems. In each part of the exams - theory and problems - a minimum of 5 points out of 10 must be obtained; in addition, in theory a minimum score must be obtained in each of the Didactic Units.

The practices will be graded by the teacher on the basis of the attendance (compulsory), and the attitude and aptitude of the students during the development of the same. Each group will have to hand in a report of the practices where all the calculations made are recorded, as well as the discussion and justification of the final results.

The tutored work will be graded (50/50) by the teacher and by the students (compulsory activity).

The qualification obtained in the laboratory practices, in the seminar and in the tutored work will be kept for the 2nd call.

Only the qualification obtained in the laboratory practicals and the tutored work will be retained for the following exams.

- **Global Evaluation Mode.**

The student who chooses this modality will have to do the laboratory practices and will take an exam on the same on the official date and whose maximum valuation will be of 20%. The remaining 80% will be assessed on the basis of an exam (on the official date) on the theoretical and practical part (divided according to the two partial parts), having to obtain a minimum of 5 points out of 10, both in theory and in practice, as well as a minimum score in theory in each of the Didactic Units.

END OF COURSE EXAMINATION

The student who chooses to take the final exam will be evaluated only with the exam (which will be worth 100% of the grade) and where there will be questions related to theory, laboratory practices and numerical problem solving. In case of not attending said exam or not passing it, he/she will be valued in the same way as the rest of the students.

OFFICIAL EXAM DATES

End of Course: 19-September-2023 (16 h).

1st Edition: 3-April-2024 (10 h).

2nd Edition: 3-July-2024 (10 h).

In case of error in the transcription of the exam dates, the valid dates are those officially approved and published on the bulletin board and on the Center's website.

Sources of information

Basic Bibliography

Olsen, E.D., **Métodos ópticos de análisis**, Reverté, S.A., 1986

Harris, D.C., **Análisis químico cuantitativo**, 2ª, Reverté, S.A., 2001

Harris, D.C., **Análisis químico cuantitativo**, 3ª, Reverté, S.A., 2007

Harvey, D., **Química Analítica moderna**, McGraw-Hill, Interamericana de España, 2002

Valcárcel, M. y Gómez, A., **Técnicas analíticas de separación**, Reverté, S.A., 1988

Hargis, L.G., **Analytical chemistry: principles and techniques**, Prentice Hall, 1988

Skoog, D.A., West, D.M., Holler, F.J. y Crouch, S.R., **Fundamentos de Química Analítica**, 8ª, Thomson-Paraninfo, 2011

Skoog, D.A., Holler, F.J. y Crouch, S.R., **Principios de Análisis Instrumental**, Cengage Learning, 2008

Complementary Bibliography

Recommendations