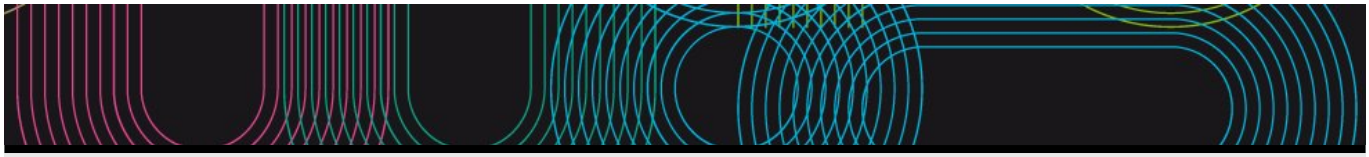

IDENTIFYING DATA				
Analytical chemistry 3				
Subject	Analytical chemistry 3			
Code	V11G200V01601			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Bendicho Hernández, José Carlos			
Lecturers	Bendicho Hernández, José Carlos Lavilla Beltrán, María Isela			
E-mail	bendicho@uvigo.es			
Web	http://faitic.uvigo.es			
General description	"Machine translation into english of the original teaching guide" - This matter provides to the students the knowledge on important and actual aspects on Analytical Chemistry (Chemometrics; Trace Analysis; Automatism and sensors), especially those regarding strategies that have allowed the evolution of the conventional methodologies to improve the quality of the analytical information. Students will be able to complement his training by means of the integration of the knowledge of Analytical Chemistry taken previously, specially the contents in Analytical Chemical II (introduction to the instrumental analysis). This will allow them to tackle the resolution of analytical problems in different areas of interest (environment, feeding, industry, clinic etc.).			

Competencies	
Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	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
C4	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: Basics and tools for solving analytical problems and characterization of chemical substances
C8	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: main techniques for structural determination, including spectroscopy
C17	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories in: metrology of chemical processes including quality management
C18	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: principles of electrochemistry
C19	Apply knowledge and understanding to solve basic problems of quantitative and qualitative nature
C20	Evaluate, interpret and synthesize data and chemical information
C22	Process and perform computational calculations with chemical information and chemical data
C24	Recognize and analyze new problems and plan strategies to solve them
C29	Demonstrate skills for numerical calculations and interpretation of experimental data, with special emphasis on precision and accuracy
D1	Communicate orally and in writing in at least one of the official languages of the University
D3	Learn independently
D4	Search and manage information from different sources
D5	Use information and communication technologies and manage basic computer tools
D6	Use mathematics, including error analysis, estimates of orders of magnitude, correct use of units and data representations

D7	Apply theoretical knowledge in practice
D8	Teamwork
D9	Work independently
D12	Plan and manage time properly
D13	Make decisions
D14	Analyze and synthesize information and draw conclusions
D17	Develop concern for environmental aspects and quality management

Learning outcomes

Expected results from this subject	Training and Learning Results		
1. Select and apply distinct technical *quimiométricas to the resolution of practical cases and justify the utilisation of the same.	A1 A2 A3	C17 C19 C20 C22	D1 D3 D5 D6 D7 D9 D13 D14 D17
2. Use the experimental design like tool for the optimisation of an analytical method.	A1	C17 C19 C22	D1 D3 D5 D6 D7 D9 D13 D14
4. Justify the utilisation of the Chemometrics in the quality of the results. Describe how implements a system of quality in a laboratory of control of analytical.	A1 A2	C4 C17 C19 C20 C29	D1 D3 D5 D6 D7 D8 D9 D14 D17
3. Evaluate and interpret the analytical results of systems *multicomponentes and *multivariables.	A1 A2 A3	C4 C17 C20 C22	D1 D3 D5 D6 D7 D8 D9 D13 D17
6. Recognise the different methods of treatment of sample as well as evaluate his possibilities in the resolution of diverse analytical problems inside the field of the analysis of trace.	A1 A2	C4 C19 C20	D1 D3 D4 D7 D9 D12 D13 D14 D17
5. Describe the planning of the sampling and the factors that take part in him for the analysis of trace.	A1	C4 C17 C24	D1 D3 D4 D6 D7 D9 D12 D13 D17

7. Compare and value the different methods of existent extraction in the actuality, like the extraction by fluent *supercríticos, in solid phase, *microextracción, etc.	A1 A2	C4 C19 C20	D1 D3 D8 D9 D12 D14 D17
8. Describe the analytical methodology and instrumentation as well as know the applications of technicians of general use in analysis of trace like the voltammetry of *redisolución *anódica, spectrometry of atomic absorption with atomisation *electrotérmica, spectrometry of masses with source of plasma and the different attachments between the chromatography and the spectrometry of masses.	A1	C4 C8 C18 C19	D1 D3 D4 D8 D9
9. Classify the different types of automatic systems and *miniaturizados, establishing his advantages and inconvenient, modalities and applications more notable and of immediate future. Justify the automation in the different stages of the analytical process.	A1 A2	C4 C17 C20	D1 D3 D4 D5 D8 D9 D17
10. Explain the foundations of the sensors and *biosensores chemical, as well as his more important applications. Explain and value the importance of the utilisation of the sensors for the fast and reliable obtaining of analytical information.	A1 A2 A3	C4 C17 C20	D1 D3 D4 D8 D9 D12
11. Describe the characteristics of the continuous automatic analysers, discontinuous and *robotizados. Know the phenomena of dispersion in continuous analysers of injection in flow and of sequential injection, as well as the form to characterise them.	A1	C4 C17 C19 C20	D1 D3 D4 D5 D8 D9 D14 D17
12. Explain the construction of analytical tools in miniature and his applications.	A1	C4 C17 C19	D1 D3 D4 D5 D9 D12 D14

Contents

Topic	
SUBJECT 1. Analysis of trace	Concept and importance of the analysis of trace. Sources of pollution in the laboratory. Experimental methods in analysis of trace. Sampling. Methods of decomposition in analysis of trace inorganic. Methods of extraction in analysis of trace organic. Technicians selected of analysis of trace.
SUBJECT 2. Automation	Automation in the laboratory of analysis: generalities. Automatic analysers. Discontinuous analysers, continuous and robotics. Analysers of injection in flow and segmented flow : characteristics. Phenomena of dispersion. Characteristics of the signal of injection in flow. Technicians of gradient. Analysers of sequential injection. Instrumentation and applications.
SUBJECT 3. Chemical sensors and biosensors	Concept of sensor. Components of a chemical sensor. Classification. Sensors and biosensors. Elements of recognition. Types of *transductores. (Bio)Electrochemical and optical sensors. Applications of interest. Miniaturisation of analytical systems.
SUBJECT 4. Introduction to the Chemometrics	Definition and historical evolution of the Chemometrics. The chemometrics in the different stages of the analytical process. Basic statistical concepts. Parameters that estimate the central value and the dispersion: parametric and no parametric. Properties of the variance and the average. Expression of analytical results.

SUBJECT 5. Basic chemometrics: comparison of analytical results	Test of significance. Proofs of hypothesis: structure of the proofs of hypothesis. Errors type I and II. Probability. Rejection of anomalous results. Parametric tests of comparison of two variances. Parametric tests for comparison of two mean values. Comparison of several mean values by means of one-way ANOVA . Control of the accuracy and precision over time: charts of control. Non-parametric tests.
SUBJECT 6. The quality in the analytical laboratories: qualimetry.	Introduction to qualimetry: quality and chemometrics. Quality and analytical properties: validation of analytical methods. trazability. Generic approximation to the quality. Systems of quality: Norms ISO. Accreditation and certification of the laboratories.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	13	26	39
Lecturing	26	52	78
Essay questions exam	2	6.5	8.5
Essay questions exam	2	6.5	8.5
Essay questions exam	4	12	16

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

Methodologies

	Description
Problem solving	In the classes of resolution of problems (in seminar) will reinforce the learning of the *temario explained during the sessions *magistrales, carrying out the resolution of numerical problems and theoretical exercises-practical. The professor will propose, of regular form, different problems/exercises that will be resolved of individual form by the student and delivered for his evaluation.
Lecturing	The professor will develop the contents of the program from the proportionate material to the student through the platform FEAR. In the sessions *magistrales, the professor will present the fundamental appearances of the matter that will have to complement by means of the bibliography recommended.

Personalized assistance

Methodologies	Description
Lecturing	The professor will resolve the doubts of personalised way on any one of the activities proposed (masterclasses, seminars, works *tutelados, resolution of problems/exercises and proofs). To such end, the professor will inform the available schedule in the presentation of the matter.
Problem solving	The professor will resolve the doubts of personalised way on any one of the activities proposed (master classes, seminars, resolution of problems/exercises and proofs). To such end, the professor will inform the available schedule in the presentation of the matter.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	In classes of seminar, the teacher will resolve part of the problems/exercises, leaving others to be resolved by the student. It will be necessary to obtain a minimum punctuation of 3 on 10 points for the qualification of this activity can add to the rest of elements of evaluation.	10	A1 A2 A3	C4 C8 C17 C18 C19 C20 C22	D4 D5 D6 D7 D8 D9 D12 D14
Essay questions exam	It will effect a first SHORT PROOF on the subjects 1, 2 and 3, roughly to half of the course. The short proof will be able to consist in questions of short answer, problems and ask type test. The presentation to this proof *inhabilita to the student to obtain the qualification of no presented.	20	A1 A2 A3	C4 C8 C17 C18 C19 C20	D1 D3 D4 D5 D6 D7 D9 D12 D13 D14 D17

Essay questions exam	It will effect a second SHORT PROOF on the subjects 4, 5 and 6 to the end of the *cuatrimestre. The short proof will be able to consist in questions of short answer, problems and ask type test. The presentation to this proof *inhabilita to the student to obtain the qualification of no presented.	20	A1 A2 A3	C4 C17 C19 C20 C22 C24	D1 D3 D4 D5 D6 D7 D9 D12 D13 D14
Essay questions exam	Compulsory FINAL EXAMINATION. It will consist in a global proof of the course that will include questions of short answer, problems and ask type test. It will be necessary to obtain 3 points on 10 in this examination so that the qualification can add to the one of the rest of elements of evaluation.	50	A1 A2 A3	C4 C8 C17 C18 C19 C20 C22 C24	D1 D3 D4 D5 D6 D7 D9 D12 D13 D14 D17

Other comments on the Evaluation

To surpass the matter, the student can opt by one of the two following types of evaluation (to choose to principle of the course):

CONTINUOUS EVALUATION
The participation of the student in any one of the two proofs of short answer programmed during the course, it *inhabilita to obtain the qualification of NO PRESENTED. To surpass the short proofs as well as the final examination, will be necessary that exist a balance in the qualifications of the theoretical part and the one of problems. The qualification in the first edition of the announcement will be integrated by the qualifications obtained in the classes of resolution of problems (*entregables) (1 point), short proofs (4 points) and final examination (5 points).

Qualification in the 2ª edition of the announcement (Julio):
The qualification in this announcement will be formed by two components:

1. Punctuations obtained by the student during the course (4 points). The weighting of the problems resolved in seminars (*entregables) will be of 0.5 points and the ones of the two short proofs of 3.5 points

2. Final examination of the contents of the matter (6 points).
This proof will include questions of short answer, problems and ask type test. It will be necessary that exist a balance in the qualifications of the theoretical part (ask type test and questions of short answer) and the one of problems to surpass the matter.

ONLY EVALUATION:
The student will be evaluated by means of an only final examination (10 points) that it will be able to include questions of short answer, problems and ask type test. It will be necessary that exist a balance in the qualifications of the theoretical part (questions of short answer and ask type test) and the one of problems to surpass the matter. The election in this way of evaluation has to communicate to the professor in a time limit of a month from the beginning of the *cuatrimestre through a form that will enable in the platform TEMA. Once chosen the way of evaluation (continuous or only) will not allow changes between both systems. In case that the student do not manifest in this regard, will understand that it follows the way of continuous evaluation.

Sources of information

Basic Bibliography

G. Ramis Ramos; M.C. Álvarez Coque, **Quimiometría**, Síntesis, 2001

J.C. Miller; J.N. Miller, **Estadística y Quimiometría para Química Analítica**, Prentice-Hall, 2002

R. Compañó Beltrán; R. Ríos Castro, **Garantía de calidad en los laboratorios analíticos**, Síntesis, 2002

C. Cámara, **Toma y tratamiento de muestras**, Síntesis, 2002

R. Cela, **Técnicas de separación en Química Analítica**, Síntesis, 2002

C. Cámara, **Análisis químico de trazas**, Síntesis, 2011

Valcárcel, **Automatización y miniaturización en Química Analítica**, Springer, 2000

Complementary Bibliography

S. Mitra, **Sample preparation techniques in analytical chemistry**, Wiley, 2003

B.R. Eggins, **Chemical sensors and biosensors**, Wiley, 2002
L. Hernández, **Introducción al análisis instrumental**, Ariel, 2002
K.A. Rubinson, **Análisis Instrumental**, Prentice-Hall, 2000
Skoog, **Principios de Análisis Instrumental**, McGraw-Hill, 2001
Kellner, **Analytical Chemistry**, Wiley-VCH, 2004
M. Valcárcel, M.D. Luque de Castro, **Flow-injection analysis. Principles and applications**, Ellis Horwood, 1987

Recommendations

Subjects that it is recommended to have taken before

Analytical chemistry 1/V11G200V01302
Analytical chemistry II/V11G200V01503