

# Bachelor's Degree in Chemistry

## Subject Guide

### 1. Information about the subject

<b>SUBJECT</b>	Experimentation in Analytical Chemistry II	<b>CODE</b>	GQUIMI01-4-001
<b>EDUCATIONAL OFFER</b>	Bachelor's Degree in Chemistry	<b>CENTER</b>	Facultad de Química
<b>TYPE</b>	Compulsory	<b>N° TOTAL CREDITS</b>	6.0
<b>PERIOD</b>	First Semester	<b>LANGUAGE</b>	Spanish
<b>COORDINATORS/ES</b>		<b>EMAIL</b>	
LOBO CASTAÑON MARIA JESUS		mjlc@uniovi.es	
<b>LECTURERS</b>		<b>EMAIL</b>	
Rodriguez Gonzalez Pablo		rodriguezpablo@uniovi.es	
Menéndez García Alberto		albertom@uniovi.es	
LOBO CASTAÑON MARIA JESUS		mjlc@uniovi.es	
Fernández Fernández Argüelles María Teresa		fernandezteresa@uniovi.es	(English Group)

### 2. Context

#### 1. Course Identifying Details

NAME	<b>Experimentation in Analytical Chemistry II</b>			CODE	
DEGREE	<b>Chemistry</b>	FACULTY	<b>Faculty of Chemistry</b>		
COURSE TYPE	<b>Compulsory</b>	TOTAL NUMBER OF CREDITS	<b>6 ECTS credits</b>		
TERM	1st Semester	LANGUAGE	English		
LECTURERS		PHONE/EMAIL		OFFICE LOCATION	
M. Teresa Fernández Abedul		985101968 <a href="mailto:mtfernandeza@uniovi.es">mtfernandeza@uniovi.es</a>		Office 199-4	

## 2. Contextualization

The course “**Experimentation in Analytical Chemistry II**” is included in the Fundamental Module, in Analytical Chemistry, of the Verifica Memory of the Degree in Chemistry. The contents of this course are closely related to those of the courses “**Analytical Chemistry II**” and

**“Analytical Chemistry III”**. They are a complement in which concerns to the experimental skills required to apply the theoretical knowledge related to analytical techniques and methodologies employed to solve analytical problems that are commonly found by chemists of the field.

This is the last experimental course of Analytical Chemistry in the Degree in Chemistry and then, it is essential to complete the experimental contents of the courses of the area that have been taken previously. On the other hand, the course **“Experimentation in Analytical Chemistry I”** has been taken before and then, students know the basics skills required in a laboratory of Analytical Chemistry.

The outcomes expected for this course: i) skills in the use of analytical instrumentation related to chromatographic, dynamic electrochemistry and spectroscopy, ii) knowledge on previous sample treatment and purification, iii) data processing and report of analytical results, as well as iv) use of primary sources of analytical bibliography, justify the interest of this course for the professional future of students.

### 3. Requirements

As a previous requirement, the student must have overcome the courses: “Experimentation in Analytical Chemistry I” of the second year as well as “Analytical Chemistry II” and “Analytical Chemistry III” of the third course.

### 4. Competencies and learning results

The **General Competencies** to be pursued in this course are those collected in the VERIFICA Memory of this Degree as CG-1, CG-2, CG-4, CG-5, CG-6, CG-8, CG-9, CG-11, CG-12, CG-14, CG-17, CG-18.

The **Specific Competencies** to be pursued are CE-6, CE-13, CE-14, CE-15, CE-18, CE-22, CE-23, CE-24, CE-25, CE-26, CE-27, CE-28, CE-29, CE-30, CE-31, CE-32, CE-35.

The expected **Learning Outcomes** are the following:

1. Extract and use analytical information in an effective way (CG-1, CG-6, CG-8, CG-9, CG-17).
2. Identify and analyse new problems in the field of Analytical Chemistry, planning adequate strategies to solve them (CG-1, CG-2, CG-4, CG-6, CG-9, CG-14, CG-17, CG-18, CE-24, CE-32, CE-35).

3. Elaborate and present correctly an oral/written report (CG-1, CG-4, CG-6, CG-8, CG-9, CG-12, CG-14, CG-17, CG-18, CE-22, CE-24, CE-30, CE-32, CE-35)
4. Demonstrate knowledge and understanding of concepts, principles and theories related to Analytical Chemistry and their application to problem solving (CG-1, CG-2, CG-6, CG-9, CG-12, CG-17, CE-6, CE-13, CE-14, CE-15, CE-18, CE-22, CE-32, CE-35)
5. Correlate the principles of the analytical technologies, spectroscopic and those employed for structural research, with their corresponding applications (CE-13, CE-15, CE-27)
6. Identify and assess the risks in the use of chemicals and laboratory procedures. (CG-11, CE-25, CE-31)
7. Perform experiments of the analytical laboratory with scientific rigour, not only in which refers to the operational protocols performed but also to the results obtained. (CG11, CG-17, CE-23, CE-26, CE-27, CE-35)
8. Know and use safely and environmentally-friendly the laboratory techniques. To make the required calculations and to express the results in the appropriate way. (CG-5, CG-12, CG-14, CG-17, CE-18, CE-23, CE-24, CE-25, CE-26, CE-27, CE-28, CE-29, CE-35)
9. Follow a chemical reaction observing and measuring chemical properties. To take the adequate information and relate it to their theoretical principles (CG-6, CE-22, CE-27, CE-28, CE-30, CE-32)
10. Obtain experimental results required for the professional practice of Analytical Chemistry (CG-11, CE-18, E-23, CE-35)

## 5. Contents

**Experiment 1** Flow injection analysis (FIA) with photometric detection.

**Experiment 2** Kinetic analysis with enzymes in solution.

**Experiment 3** Fabrication and evaluation of an amperometric sensor.

**Experiment 4** Gas chromatography (GC) with flame ionization detection (FID).

**Experiment 5** High-performance liquid chromatography (HPLC).

## 6. Methodology and working plan

The students will perform the experiments under the supervision of the corresponding teachers using the materials given by them.

In each of the experiments students will follow the next steps:

1. Previous study of the analytical problem, nature and characteristics of the samples and physico-chemical fundamentals of the analytical methodology proposed for solving the problema. The materials that have to be used, given by the supervisor, include a brief description of the

problem and the analytical methodology as well as some related bibliography.

2. Understand the approach to solve the problem, the difficulties of the problema and the fundamentals of the methodology that is proposed to solve it.

3. Follow the explanation of the teacher and the discussion with students about operational aspects and related concepts that are difficult to understand.

4. Plan the experimental tasks that have to be performed. Notes will be taken in the corresponding personal lab book. This will include the protocols of the analytical methodology, that have been adjusted to the sample that is going to be analysed.

5. Perform the experimental tasks. They will be made by the students under the supervision of the teacher. Data will be recorded in the lab book together with other relevant information.

6. Elaborate and present a written report for each of the experiments. The analytical results obtained have to be included together with the corresponding precision.

7. Answer questions related to the basis of the experiments that have been performed, and discussion, lead by the teacher, about the quality of the results.

### Working plan

		In-class work				Out-of-class work		
<i>Units</i>	<i>Total hours</i>	<i>Seminars</i>	<i>Laboratory sessions</i>	<i>Evaluation</i>	<i>Total</i>	<i>In groups</i>	<i>Individual</i>	<i>Total</i>
Introduction to	<b>3</b>	2			<b>2</b>		1	<b>1</b>

the course. Safety rules								
Searching for information related to analytical methodologies	<b>12</b>	2			<b>2</b>	6	4	<b>10</b>
Discussion about the selection of the most appropriate analytical methodology to solve the problems	<b>11</b>	2			<b>2</b>	5	4	<b>9</b>
Experiment 1	<b>19</b>		10		<b>10</b>	4	5	<b>9</b>
Experiment 2	<b>19</b>		10		<b>10</b>	4	5	<b>9</b>
Experiment 3	<b>19</b>		10		<b>10</b>	4	5	<b>9</b>
Experiment 4	<b>19</b>		10		<b>10</b>	4	5	<b>9</b>
Experiment 5	<b>19</b>		10		<b>10</b>	4	5	<b>9</b>
Written test on the basis of the experiments	<b>29</b>			4	<b>4</b>		25	<b>25</b>

<b>Total</b>	<b>150</b>	6	50	4	<b>60</b>	31	59	<b>90</b>
--------------	------------	---	----	---	-----------	----	----	-----------

## 7. Evaluation of the student's learning results

### - Ordinary call

Aspect	Criteria	Instrument	Weight
Experimental work	<ol style="list-style-type: none"> <li>1. Degree of understanding of the activity and of the analytical techniques employed</li> <li>2. Planning and performance of the experimental activity.</li> <li>3. Accuracy and precision of the results.</li> <li>4. Quality and rigour of the reports presented.</li> </ol>	<p>Attendance and participation in class activities</p> <p>Revision of the laboratory notebook</p> <p>Observation, teacher's notes and revision of the reports</p>	50%
Fundamentals	Knowledge of the	Written exam	50%

and calculations	theoretical fundamentals and calculations required for obtaining and expressing the analytical results.		
------------------	---	--	--

It will be required to obtain the 50% of the points en each aspect for passing the course.

- **Extraordinary call**

The evaluation will follow the criteria considered in the ordinary call, but students that have not overcome the Experimental Work in the first call, or those wanted to be evaluated again, will take a practical exam. This will consist of doing in the lab one or more steps of one of the analytical procedures included in the lab guide. Both exams, this and the theoretical one, will take place the same day.

In the case of students that have overcome the Experimental Work and do not want to be evaluated again, the final mark will be this of the written test.

## **8. Resources, bibliography and complementary documentation**

### **Resources:**

All the reagents, materials and instrumentation required for performing the experiments.

## **Bibliography:**

- *Quantitative Chemical Analysis*, D. Harris, 8ª Edición, W.H. Freeman and Company, 2010.
- *Principles of Instrumental Analysis*, 6th Edition. D.A.Skoog, F.J.Holler, S.R.Crouch; ISBN-13:978-0495012016.
- *Chemical Analysis. Modern Instrumentation, Methods and Techniques*. 2nd Edition; F. Rouessac, A. Rouessac. Wiley, 2007

The texts for introducing the experiments will be available in the Campus Virtual. The rest of the documentation considered as relevant for the performance and understanding of the experiments will be also uploaded in the same platform.

