COURSE DATA

DATA SUBJECT

Code: 34232
Name: Analytical Chemistry Laboratory II
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	3	First quarter
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	5	First quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	4	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Analytical Chemistry	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Quinto Curso (Obligatorio)	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Cuarto curso	COMPULSORY

COORDINATION

BENEDE VEIGA JUAN LUIS

SUMMARY

Analytical Chemistry Laboratory II is a core course taught in the third year (fall semester) of the Degree in Chemistry for a total of 6 ECTS credits.

This course familiarizes students with the most common analytical instrumental techniques (both the fundamentals of the technique and the optimization of the chemical and instrumental working conditions) and the treatment of the analytical signals produced by each technique. In their laboratory work students will acquire an awareness of the risks of using the instrumentation for each technique and the importance of respecting the safety rules in each case.

The course also introduces students to the field of application for these techniques and how the techniques are used to solve a wide range of problems.

Experiments are conducted using optical methods of analysis, electroanalytical methods, and separation methods.

Regarding the Sustainable Development Goals (SDG), it is expected that students will be able to know in this subject how to apply the knowledge learned to guarantee an inclusive, equitable, and quality education and promote learning opportunities for everyone (SDG 4), to acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and energy sources (SDG 7), as well as for an environmentally friendly and sustainable development (SDG 11 , 12, 13, 14 and 15), in addition to being able to design, select and/or develop efficient chemical products, processes and/or analytical methodologies (SDG 7) that minimize their impact on the environment (SDG 14 and 15), using alternative raw materials and reducing wastes (SDG 11).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

1110 - Degree in Chemistry
Obligation to take the subject(s) simultaneously — 34230 - Analytical Chemistry III

1929 - Double Degree Program in Physics and Chemistry
Obligation to take the subject(s) simultaneously — 34230 - Analytical Chemistry III

1934 - Double Degree Program in Chemistry-Chemical Engineering
Obligation to take the subject(s) simultaneously — 34230 - Analytical Chemistry III

OTHER REQUIREMENTS

To successfully complete this course, students should have acquired experience of working with instrumental techniques and knowledge of the main instrumental analysis techniques. They must therefore have passed Analytical Chemistry II and be in the process of taking Analytical Chemistry III. This will enable them to relate the contents of the theoretical lectures with the practice sessions conducted in Analytical Chemistry Laboratory I.

COMPETENCES / LEARNING OUTCOMES

1110 - Degree in Chemistry

Act autonomously in learning, making informed decisions in different contexts, forming judgements based on experimentation and analysis, and transferring knowledge to new situations.

At the end of the course, the student will be able to address new problems and develop strategies to solve them.

At the end of the course, the student will be able to apply metrology in chemical processes, including quality management.

At the end of the course, the student will be able to assess risks in the use of chemical substances and laboratory procedures.

At the end of the course, the student will be able to distinguish between qualitative and quantitative aspects of chemical problems.

At the end of the course, the student will be able to distinguish the principles, procedures and techniques used for the determination, separation, identification and characterisation of chemical compounds.

At the end of the course, the student will be able to identify chemical processes in everyday life.

At the end of the course, the student will be able to identify the main types of chemical reactions and their key characteristics.

At the end of the course, the student will be able to implement sustainable and environmentally friendly methodologies.

At the end of the course, the student will be able to relate theory and experimentation.

At the end of the course, the student will be able to solve problems effectively.

At the end of the course, the student will be able to state the principles of thermodynamics and kinetics and apply them in chemistry.

At the end of the course, the student will correctly use chemical terminology, nomenclature, conventions and units.

At the end of the course, the student will demonstrate inductive and deductive reasoning skills.

At the end of the course, the student will demonstrate the ability to analyse, synthesise and apply critical reasoning.

At the end of the course, the student will interpret the relationship between the variation of the characteristic properties of chemical elements and the periodic table.

At the end of the course, the student will relate chemistry to other disciplines.

Collaborate effectively in teams, assuming responsibilities and leadership roles and contributing to collective improvement and development.

Communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

Contribute to the design, development and implementation of solutions that address social needs, taking the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical reasoning within the field of study, considering aspects such as professional ethics, moral values and the social implications of the different activities undertaken.

Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Propose creative and innovative solutions to complex situations or problems within the field of study, in order to respond to diverse professional and social needs.

Understand and recognise, from within the discipline, inequalities based on sex and gender in society; integrate different needs and preferences related to sex and gender into problem-solving and solution design.

DESCRIPTION OF CONTENTS

1. Optical analytical methods

This thematic unit includes the realization of a series of practices in which the use of different optical methods of analysis is proposed for the determination of analytes of different nature in samples of very varied composition. Many of them also include the study of the influence of different variables, both chemical and instrumental. The scheduled internships are as follows:
1.1) Determination of food colorants in a moraen food liquor: separation using solid phase extraction and determination by UV-vis absorption spectroscopy.
1.2) Influence of instrumental variables in molecular fluorescence: determination of quinine in tonic water.
1.3) Analytical applications of infrared spectroscopy.
1.4) Determination of calcium in milk by flame atomic absorption spectroscopy.
1.5) Determination of lithium in natural waters: study of the variables that affect the analytical signal.

2. Electroanalytical Methods

The practice sessions in this thematic unit use some of the most common electroanalytical techniques, e. g. potentiometric and electroplating techniques. One practice session uses voltammetric determination and therefore involves the study and visualization of current-potential curves. The scheduled practice sessions are:
2.1) The use of selective electrodes for the potentiometric determination of fluoride in toothpaste.
2.2) The electrogravimetric determination of copper in brass.
2.3) Analytical applications of voltammetric techniques.

3. Chromatographic Methods

The three practice sessions in this thematic unit involve differents techniques of separation,column liquid chromatography and gas chromatography. The scheduled practice sessions are:
3.1) Determination of caffeine by liquid chromatography.
3.2) Determination of phenols in urine samples by gas chromatography.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	12,00
Laboratory	48,00

Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	25,00
Independent study and work	38,00
Preparation of lessons	17,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The materials (scripts, guidelines, schedule, questions, etc.) will be made available to students via the virtual classroom before the beginning of the introductory session. Before work in the laboratory, each block of sessions will begin with a seminar to:

Explain the general rules of Analytical Chemistry Laboratory II.

Explain how the course will develop and discuss the various sections of this course guide.

Introduce skills students have not previously acquired but are necessary for the subject and, if appropriate, discuss any previous knowledge required.

Provide the information and materials students will need to prepare the first practice session or first block of sessions.

The course is structured around the following axes:

(i) Preparation of the practice to be conducted.

The student must prepare a work outline in the laboratory notebook

It is intended to advise that the student understand the foundation of what she is going to do, and the reasons why experimental techniques are applied in a certain way and not in another.

The aim of this preparation is to ensure that, before entering the laboratory, students understand what they need to do and why.

(ii) Laboratory work.

The sessions are conducted in pairs. Sometimes, however, in order to encourage teamwork, several pairs

may share their results. At this stage of the work the lecturer will encourage a positive attitude from students toward their scientific work.

Keeping a laboratory notebook during their practical sessions is an important part of the students' laboratory work (point iv). At no time should the notes in the laboratory notebook be re-written.

(iii) Treatment of the results.

The treatment of the results will begin in the laboratory. The lecturer will first guide the students in this task before the students complete the work by themselves. When presenting the results of the laboratory sessions, students must draw appropriate figures and tables to collect the data and use the correct units and significant figures. As the aim of this stage is to develop the students' analytical skills, they must not only calculate the results they obtain in the laboratory but also analyse them as well as their previous estimates.

(iv) Laboratory notebook and analytical reports.

Students must learn to carry a laboratory notebook in which he indicates the work he has done. The student will upload the scanned laboratory notebook daily to the virtual classroom assignment and submit the analytical reports within the time limit set by the teacher.

(v) Individually, once the laboratory sessions have finished, the student must carry ou tan individual evaluation activity on the experimental procedure including sample pretreatment, the selected analytical technique, the experimental procedure and potential interferences.

EVALUATION

FIRST CALL

Students' grades will be calculated from the weighted average of different activities: preparation and execution of the experiments; results of analyses of the samples; laboratory notebook and analytical reports; and a written exam. Two parts will be considered:

1. Experimental work and results (70 %):

The following aspects will be evaluated in this part:

(a) Preparation of the practice before the laboratory session

(b) Laboratory work: there will be a continuous evaluation of the progress and work carried out by the students. The teacher will consider the student's abilities in laboratory work, interest and attitude. The

progress made in the proper implementation of experimental techniques will be specially assessed.

(c) Laboratory notebook

(d) Analysis of test samples: At each practice session students must analyse a sample of unknown composition and/or concentration. The quality of the results obtained is considered to reflect the quality of the experimental work carried out by the student. Moreover, the student will prepare an analytical report with all the experimental results obtained.

(e) Individual evaluation of the experimental procedure including sample pretreatment, the selected analytical technique, the experimental procedure and potential interferences.

2.- Exam (30%)

At the end of the course students will take a written exam.

The overall grade will be calculated as the weighted average of the two parts. To pass the subject it is necessary to obtain a minimum average grade of 5.0 and reach a minimum score of 4.5 points on a scale of 0 to 10 in each section.

Experimental work and results	Examinations
70%	30 %

Attendance at all seminars and laboratory sessions is compulsory and lost sessions cannot be recovered. The grade awarded for a session not recovered will be zero.

SECOND CALL

In the second call the final grade is obtained by applying the same weighting criteria as in the first call. There will be a written examination (worth 30%) and a practical examination in the laboratory (70%).

NOTE: This course is excluded from the regulations on advance calls for completing graduate studies

(Degree Committee agreement of 26/03/2015).

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30),

"*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

REFERENCES

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- SKOOG, D.A.; HOLLER, F. Y CROUCH, S.R. Principios de Análisis Instrumental (6ª edición). México: Cengage Learning Editores, 2008. ISBN 9789706868299
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