VNIVERSITAT DE VALÈNCIA

Course Guide

36459 Applied Instrumental Analysis Laboratory

COURSE DATA

DATA SUBJECT

Code: 36459
Name: Applied Instrumental Analysis Laboratory
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	4	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Analytic Chemistry Applied	ELECTIVES

COORDINATION

CARRASCO CORREA ENRIQUE JAVIER

SUMMARY

On this course students will put into practice the knowledge they have acquired on previous courses in Analytical Chemistry. These include the theoretical courses Analytical Chemistry I, Analytical Chemistry II and Analytical Chemistry III, and two laboratory courses taken in the second and third academic years of the Degree in Chemistry (Laboratory of Analytical Chemistry I and Laboratory of Analytical Chemistry II).

The course comprises sixteen laboratory sessions and four seminars. At the seminars, the students are introduced to the subject and taught how to search for information on official methods of analysis, sample treatments, and the treatment of the analytical results so that they can prepare a working procedure before beginning their experiments.

By working in the laboratory and analysing real samples, students will establish contact with the world of industry and analytical control laboratories. Students will also gain an awareness of the risks entailed by using the instrumentation and reagents and therefore of the importance of respecting the safety rules established in each case.

The course includes practical training that covers environmental analysis, food analysis, and industrial products as well as the use of optical methods of analysis, electroanalytical methods and the most common separation methods used in quality control laboratories.

Related to the Sustainable Development Goals (SDG's) in this course, students are expected to be able to apply the learned knowledge to ensure inclusive, equitable and quality education and promote learning opportunities throughout their life (SDG4), to acquire a special sensitivity for the sustainable management of water (SDG 6), raw materials and energy sources (SDG 7) as well as for sustainable and environmentally friendly development (SDGs 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) minimizing their environmental impact (SDG 14 and 15), take advantage of alternative raw materials and generate less waste (SDG 11).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

To successfully complete the course, students should have some prior knowledge of working in an Analytical Chemistry laboratory and a sound knowledge of the theoretical aspects of Analytical Chemistry, including instrumental techniques. They must therefore have passed Analytical Chemistry I, II and III and the two laboratory courses taught in the second and third academic years of the Degree (Laboratory of Analytical Chemistry I and Laboratory of Analytical Chemistry II).

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 elements and compounds, including their production, structure, reactivity, properties and applications.

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 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 data from observations and measurements in the laboratory in terms of their significance and the theories that support them.

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

Capacidad de análisis, síntesis y razonamiento crítico en la aplicación del método científico.

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.

Comprender las particularidades contables que presenta la regulación jurídico-mercantil de las empresas, relacionando la legislación mercantil aplicable a los distintos tipos operaciones societarias con la contabilidad de los hechos económicos que se regulan. Aprender a relacionar las leyes mercantiles que se ocupan de los concursos de acreedores con la contabilidad, adquiriendo práctica en el manejo de determinados textos legales vigentes.

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.

Handle the instrumentation used in the different areas of chemistry.

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. Analysis of Environmental Samples

In this thematic unit students attend a series of practical training sessions in which they use different instruments and sample treatment methods and apply official methods of analysis with the emphasis on solid samples. Parameters such as moisture, pH, conductivity, ammonia, organic matter, phosphates and heavy metals in soil will be determined. The values obtained will be compared to the limits established by legislation for the various types of soil analysed.

2. Food and Industrial Analysis

In this thematic unit, official methods for controlling industrial products and food will be used and the results will be compared to the values reported in the legislation.
The importance of food analysis will be stressed since this sensitive sector is directly related to human health. Samples of oil, pasta, cocoa, juices, honey, will be analysed in order to establish their state of preservation, determine any toxic pollution and detect fraud.

3. Pharmaceutical and Clinical Analysis

In this thematic unit, official methods for controlling pharmaceutical products and parameters in a typical clinical laboratory analysis will be used.
Specifically, creatinine in urine will be determined by the Jaffe method.

4. Search and selection of the most appropriate analytical method

In this thematic unit, students will conduct a search of the analytical methods proposed in the scientific literature for the determination of a specific analyte in a sample provided by the teacher. In the first seminar of the subject, each one will be shown what sample and which analyte will have to analyze in order to have sufficient time to carry out the bibliographic search. Subsequently, and using the conditions described in the method sought, they will perform the determination in the laboratory.

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	26,00
Independent study and work	36,00
Preparation of lessons	14,00
Preparation for assessment activities	14,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The course will be taught using the following methods:

- Previous issues
- Practical classes
- Participatory classes
- Seminars
- Information searches

Before each laboratory session, a questionnaire will be answered with questions related to the practice that will be carried out. Those students who do not pass this questionnaire will not be able to enter the laboratory and therefore will not be able to carry out the practice of that session.

Before the beginning of each session the materials will be made available to the students via the virtual classroom. Each block of sessions will begin with a seminar.

As well as serving to present the subject, the aim of the seminars is teach students how to search for information on official methods of analysis, necessary sample treatments, and the treatment of analytical results so that they develop a work procedure before conducting their experiments.

In each block the skills needed to develop the subject will be introduced and the importance of developing the analytical report will be explained.

The course is structured as follows:

1. Preparation of the practical work.

Students prepare an outline of the formal method and the calculations needed to conduct the analysis. The lecturer will review the material prepared by the students before the practical work begins.

2. Experimental work.

Practical work is conducted in pairs. The work of the lecturer at this stage is to encourage a positive attitude from the students in their scientific work.

Regularly updating their laboratory notebook during their practical work is an important component of the

students' laboratory work.

3. Treatment of results

Treatment of results is conducted in the laboratory. The aim of this stage is to develop students' analytical ability. Student should not only obtain the results in the laboratory but also analyse them and their previous calculations, expressing their results in the appropriate units and with significant figures.

4. Laboratory notebook and analytical reports.

Student must regularly update their laboratory notebooks. The lecturer will periodically review this laboratory notebook, and it will be evaluated by pairs through a rubric.

EVALUATION

To pass the course students must attend at least 90% of the seminars and laboratory sessions. The system of evaluation is as follows:

- Previous issues
- Written, oral or practical examinations.
- Evaluation of laboratory sessions will focus on the students' attitude and skills and the quality of their laboratory notebooks, results, papers, practice reports, and oral communication.

FIRST CALL

Students' grades are calculated from the average of the two above evaluations (30% for the examinations and 70% for the laboratory sessions and the previous questionnaires). To pass the course, students must obtain a minimum average of 5.0 and a minimum score of 4.5 points out of 10 on each section.

1. Examination (30%):

The student will sit an examination on topics related to their practical work.

1. Evaluation of the laboratory sessions (70%) based on:

- Preparation conducted prior to the laboratory session, by means of the realization of questionnaires (5%) and revision of the scheme and previous calculations of the laboratory notebook (5%).

- Work conducted in the laboratory (10%). A continuous assessment of the progress achieved and the work conducted during the practical sessions will be made taking into account the student's ability in the laboratory work, their interest and their attitude. In particular, progress made in implementing a proper experimental technique will be evaluated.
- Analysis of unknown samples (35%). During each practice session, students must analyse and make an analytical report of a sample problem of unknown composition and/or concentration. The quality of the results obtained is considered an accurate reflection of the quality of the experimental work conducted.
- Laboratory notebook (15%). The laboratory notebook must be developed in accordance with the lecturer's guidelines and it will be evaluated through the use of a rubric.

Attendance at all seminars and laboratory sessions is compulsory. In the case of excused absences, students can recover up to three sessions by attending other practical groups provided the teaching requirements of the laboratories allow. The marks awarded for any session not recovered in this way will be zero. Students will fail the course if they are absent from or fail to recover more than two laboratory sessions.

SECOND CALL

The second call will consist of a written examination and/or a practical examination in the laboratory to evaluate students' preparation for the practical sessions, their work conducted in the laboratory, their laboratory notebook and their analytical reports.

Students' grades will be calculated following the criteria applied for the first call.

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*".

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