COURSE DATA

DATA SUBJECT

Code: 34065
Name: Instrumental Techniques
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Facultat de Farmàcia i Ciències de l'alimentació	1	Second quarter
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Facultat de Farmàcia i Ciències de l'alimentació	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	Instrumental techniques	COMPULSORY
1211 - Double Degree in Pharmacy and Human Nutrition and Dietetics	Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	COMPULSORY

COORDINATION

PEREZ GIMENEZ FACUNDO

SUMMARY

Instrumental Techniques is a obligatory subject in the first course, second semester, of the Degree in Pharmacy and it takes 6 ECTS credits. In this subject, the student is provided with a complete and updated description of the instrumental techniques that the pharmacist will need in different areas of his practice, whether in research, teaching, pharmaceutical, specialty hospital or pharmacy. It is important to consider that for the pharmacist, the instrumental methods based on the measurement of physical or physico-chemical magnitudes, are used not only for pure analytical purposes but also for others such as structural investigations, kinetic studies and chemical stability of drugs, pharmacological and toxicological tests, pharmacokinetics and bioavailability, among others.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

It is highly desirable that students have studied Mathematics II and Physics, in the second course of high school. The Physics and Chemistry subjects studied in the first semester, are considered basic and essential for the development and learning of this discipline.

COMPETENCES / LEARNING OUTCOMES

1201 - Degree in Pharmacy

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

Apply the scientific method and acquire skills in handling the main bibliographic sources.

Be able to analyse active ingredients, pharmaceuticals and other products and materials of health interest.

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

Contribute to the design, development and implementation of solutions that respond to social demands, taking into account the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical thinking in the field of the degree programme, considering aspects such as professional ethics, moral values and the social implications of the different activities carried out.

Develop the ability to work in a team, as well as the critical capacity to process information.

Know and understand, within the field of the degree programme, gender inequalities in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem solving.

Know how to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

Know how to interpret, evaluate and communicate relevant data in the different areas of pharmaceutical activity, using information and communication technologies.

Module: Chemistry. Acquire the ability to select appropriate techniques and procedures for the design, application and evaluation of reagents, analytical methods and techniques.

Module: Chemistry. Develop skills to carry out standard laboratory processes, making proper use of scientific synthesis and analysis equipment and instrumentation.

Module: Chemistry. Know and apply the main techniques of structural research, including spectroscopy.

Module: Chemistry. Know the principles and procedures for the analytical determination of compounds: analytical techniques applied to the analysis of water, food and the environment.

Module: Chemistry. Understand the origin, nature, design, production, analysis and control of medicines and health products.

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

DESCRIPTION OF CONTENTS

1. ELECTROMAGNETIC RADIATION

Nature of the electromagnetic radiation (EMR). Electromagnetic Spectrum. REM-Matter Interaction. Energy Diagrams.

2. EMISSION AND ABSORPTION OF EMR

Principal Laws: Boltzmann equation. Lambert-Beer equation. Absorption and emission spectra.

3. BASIC COMPONENTS OF THE SPECTROSCOPIC INSTRUMENTAL

REM sources. Wavelength selectors. Simple holders. Detectors.

4. ATOMIC EMISSION SPECTROPHOTOMETRY

Flame Photometry and Plasma Spectroscopy: Fundamental, instrumentation and applications in Pharmacy.

5. ATOMIC ABSORPTION SPECTROPHOTOMETRY

Basis, instrumentation and applications in Pharmacy.

6. MOLECULAR SPECTROSCOPY

Molecular energy levels and energy transitions.

7. INFRARED SPECTROSCOPY

Basic principles. Vibration of diatomic molecules. Anharmonicity. Vibration of polyatomic molecules. Instrumentation and applications in Pharmacy.

8. RAMAN SPECTROSCOPY

Mechanisms of the Raman and Rayleigh dispersions. Raman spectrophotometers. Applications to biological systems.

9. ULTRAVIOLET AND VISIBLE SPECTROSCOPY

Principles. Diatomic and polyatomic molecules. Transitions in organic and inorganic systems. Instrumentation. Applications in Pharmacy

10. MOLECULAR FLUORESCENCE SPECTROSCOPY

Fundamentals. Quenching. Factors involved in molecular fluorescente. Intrumentation and applications in Pharmacy

11. NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Principles. Chemical shift and spin-spin coupling . Instruments and applications in Pharmacy.

12. ION MOVILITY SPECTRIOMETRY AND MASS SPECTROMETRY

Principles, instrumentation and applications in Pharmacy.

13. LABORATORY

Spectroscopy UV-V. Verification of Lambert-Beer Law
Spectroscopy of molecular fluorescence
Electrophoresis of serum proteins
Flame photometry/Atomic Absorption
Conductimetry
Complex stoichiometry by UV-visible spectroscopy

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00
Theory	30,00
Seminar	3,00
Laboratory	24,00

Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	30,00
Preparation of lessons	30,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The subject's development is arranged around four types of activities: The theoretical classes, the laboratory practical classes, the tutorials and the work presentations.

Theoretical Classes. The students must acquire the basic knowledge according to the program outlined above mainly by their individual study as well as the master classes attendance. In such magisterial classes, the teacher will draw, during two hours per week, a global picture of the Program: He will emphasize the key concepts allowing the student a correct understanding of the matter and will respond any questions the students may pose. The students will have at their disposal a basic and complementary bibliography, web sites of interest and supporting computer material. They will also be trained so that they can use all this information in the most profitable way possible. Moreover, they will have available a virtual classroom with supplementary material in order to ease their study.

Laboratory Classes. First of all, the students must read and understand well the classes in advance, the fundamentals and development of each one and every experiment included in the practical notebook.

Once in the laboratory, the teacher will expose briefly the principal aspects of the experiment to carry out and will answer any question from the students.

The selection and consumption optimization of reagents for the generation of least waste have been deeply considered in the preparation of the Lab Sessions, in order to raise awareness of the students in the proper use of them as a part of sustainable development.

After the experimental procedure is ended, the student will analyze the results achieved and will perform the corresponding calculations.

Finally he will present a memory over all the results and features at the laboratory while he was in there. The student must not only explain the correct results but, whether necessary, will also explain the possible failures. Such a memory will be graded by the teacher who will also put an exam to fully evaluate the student's comprehension of the matter.

Tutorials. The students will attend the tutorials in groups of 16 each during 3 sessions of 1 hour each.

Thereby the possible doubts and /or suggestions of the students will be answered. Furthermore, the teacher will also propose them additional or alternatives ways to reinforce knowledge acquired.

Seminars. The students may choose to elaborate and expose a work about any of the monographic themes proposed by the teacher. The work's content may be mono or multidisciplinary and its purpose is stimulating in the students the social capabilities mentioned above.

EVALUATION

The students' evaluation will have into account all aspects mentioned in the previous items, particularly in the *Methodology*, and it will be done by the teacher continuously.

15 percent of the mark will come from a continuous evaluation (works' preparation and presentation, questionaries, workshops of problems, tutorials, attendance, etc.)

At the end of the semester it will be carried out a written theory exam (oral if necessary) consisting of conceptual or reasoning questions allowing the student to demonstrate the degree of assimilation of fundamental concepts. Occasionally it could also include developing topics that would demonstrate the students' synthetic and exposure capabilities, as well as multiple choice questions. The theory exam will represent 60 percent of the overall mark.

Laboratory practices, which are of obligatory attendance, will account for 25% of the final mark (from which 60% will come from an exam about development of the practicals, to be held alongside the theory exam, and the remaining 40% will evaluate the memory of individual practices, as well as the work and participation of the student, both in the laboratory and in the previous preparation of the practices and in carrying out the calculations). Those students repeating the year with the practicals approved in previous years, three more academic years.

Laboratory practices, tutorials and seminars are MANDATORY ATTENDANCE and, therefore, NOT-RECOVERABLE, in accordance with the provisions of article 6.5 of the UV Evaluation and Qualification Regulations for Bachelor's and Master's degrees. In the event that, for justified reasons, it is not possible to attend any of these activities, students must contact the responsible in advance. In this way, the person responsible for the subject will be able to assign the student a session in another group.

To pass the course, it is necessary to obtain a minimum score of 4 out of 10 points in both, theory and laboratory marks, as well as a rating of 5 out of 10 in the final mark.

The final mark is calculated as follows:

FINAL MARK = THEORY x 0,60 + PRACTICALS x 0,25 + TEACHER EVALUATION x 0,15

Those students that do not attend the final theory exam will be graded in the Act of the 1st call as \\"not presented". In the 2nd call, the rating will be \\"failed\\", if they had participated in any of the measurable

academic activities of the course, scheduled in this teaching guide, even if they had not attended the final theory exam.

Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents.

In the event of fraudulent practices, the "**Action Protocol for fraudulent practices at the University of Valencia**" will be applied (ACGUV 123/2020): https://www.uv.es/sgeneral/Protocols/C83sp.pdf

REFERENCES

- PRINCIPIOS DE ANALISIS INSTRUMENTAL. Skoog / Holler / Nieman. 5ª Edición. Ed. McGraw-Hill. -TÉCNICAS INSTRUMENTALES EN FARMACIA Y CIENCIAS DE LA SALUD. Oriol Valls, Benito del Castillo. Ed. Piros Barcelona. -PRINCIPIOS DE ANÁLISIS INSTRUMENTAL. James W. Robinson. Ed Acribia. Zaragoza.

- MANUAL DE TÉCNICAS INSTRUMENTALES. J. Miñones Trillo. Círculo Editor Universo. Barcelona.