COURSE DATA

Data Subject	
Code	34065
Name	Instrumental Techniques
Cycle	Grade
ECTS Credits	6.0
Academic year	2018 - 2019

Study (s)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	1	Second term
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	1	Second term

Subject-matter

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	5 - Instrumental techniques	Obligatory
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
PEREZ GIMENEZ, FACUNDO	315 - Physical Chemistry

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.

OUTCOMES

LEARNING OUTCOMES

As a basic core subject taught in the first cycle of the degree, the course must:

- Serve as a link between the subjects that the student has completed and the requirements needed over the degree.
- Provide the knowledge necessary for proper understanding and use of various instrumental techniques which the pharmacist needs in his professional development, describing the general and particular fundamentals from each of them, the most characteristic instruments and major pharmaceutical applications of each technique.
- Provide the basis for a proper understanding of the concepts and methods outlined in other subjects of the Degree such as Pharmaceutical Chemistry, Pharmacology, Pharmacognosy, Pharmaceutical Technology, Biological analysis and laboratory diagnosis, Biochemistry, Microbiology and Parasitology, among others.
- Provide the necessary knowledge and instrumental support for the rational study of drugs in their aspects related to preparation, analysis, stability, mechanism of action, etc.

Students should acquire the following skills:

• To acquire basic knowledge related to the nature of electromagnetic radiation and its interaction with various material media.

• Assimilate fundamental concepts such as Transmission, Absorption, Emission, Fluorescence and Scattering of Electromagnetic Radiation, relating to the characteristics of the material where they occur.

• Relate the phenomena of interaction of electromagnetic radiation with matter, with the energy levels of atoms and molecules and the information following them.

• Interpret the qualitative and / or quantitative information provided by the atomic and molecular spectra.

• Appropriately manage the spectroscopic instruments available in the Laboratory and interpret the results.

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 AND FLUORESCENCE SPECTROPHOTOMETRIES

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. OPTICAL ROTATION AND CIRCULAR DICHROISM

Fundamentals. Instrumentation and applications to Pharmacy.

12. NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

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

13. X RAY SPECTROSCOPY

X Ray emision. X Ray absorption, fluorescente and siffraction spectra. Instrumentation and applications.

14. MASS SPECTROMETRY

Principles, instrumentation and applications in Pharmacy.

15. ELECTROCHEMICAL TECHNIQUES

Conductimetry, potentiometry and voltametry: Fundamentals, instrumentation and applications in Pharmacy.

16. LABORATORY

Verification of Lambert-Beer Law
Molecular fluorometry
Electrophoresis of serum proteins
Flame photometry/Atomic Absorption
Conductimetry
Complex stoichiometry by UV-visible spectroscopy

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	24,00	100
Seminars	3,00	100
Tutorials	3,00	100
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	25,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	22,00	0
Preparation of practical classes and problem	8,00	0
TOTAL	**150,00**	

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.

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

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, arranged in groups of six member each, 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 consisting of conceptual or reasoning questi allowing the student to demonstrate the degree of assimilation of fundamental concepts. Occasionally it could also developing topics that would demonstrate the students' synthetic and exposure capabilities. The theory exam will represent 60 percent of the overall mark.

The laboratory practicals, which are of obligatory attendance, will account for 25% of the final mark (from which will come from an exam about matters concerning the development of the practicals, to be held alongside the theor exam, and the remaining 40% will evaluate the student's work and his/her participation in the laboratory tasks and delivering of results). Those students repeating the year with the practicals approved in previous years, will hold th up to a maximum of three more academic years.

To pass the course, it is necessary to obtain a minimum score of 4 out of 10 points in both, theory and laboratory m 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". 2nd call, the rating will be "failed", if they had participated in any of the measurable academic activities of the cour scheduled in this teaching guide, even if they had not attended the final theory exam.

REFERENCES

Basic

- 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.

Additional

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