COURSE DATA

DATA SUBJECT

Code: 36597
Name: Physical Chemistry Laboratory
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	5	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1929 - Double Degree Program in Physics and Chemistry	Quinto Curso (Obligatorio)	COMPULSORY

COORDINATION

PEREZ PLA FRANCISCO

BARTUAL MURGUI CARLOS

SUMMARY

The Physical Chemistry Laboratory is a compulsory course taught during the second semester of the fifth year of the double degree in Chemistry and Physics. In the course, students acquire knowledge and skills related to experimentation in the following parts of Physical Chemistry: Spectroscopy, Electrochemistry, Photochemistry, Theoretical Chemistry and Chemical Kinetics. During the laboratory classes, various instrumental techniques are applied to the study of chemical-physical systems of interest, and mechanoquantum calculations oriented to the study of atoms and molecules are performed with personal computers.

In relation to the Sustainable Development Goals (SDGs) in this subject, students are expected to be able to apply the knowledge learned to contribute to ensure inclusive, equitable and quality education and promote learning opportunities (SDG 4) and acquire a special sensitivity for a sustainable management of water (SDG 6), raw materials and energy sources (SDG 7) as well as for a sustainable and environmentally compatible development (SDG 11, 12, 13, 14 and 15). Also, to design, select and/or develop efficient chemical products and processes (SDG 7) that minimize their impact on the environment (SDG 14 and 15), use alternative raw materials and generate less waste (SDG 11).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

1929 - Double Degree Program in Physics and Chemistry

Obligation to take the subject(s) simultaneously	36596 - Elements of Physical Chemistry

OTHER REQUIREMENTS

R5 - OBLIGATION TO HAVE PASSED OR TO TAKE THE COURSE SIMULTANEOUSLY
36596 - Elements of Physical Chemistry.

It is recommended that the student has basic knowledge of chemical nomenclature and numerical calculus, and knowledge of Chemistry-Physics related to:
- Formal kinetics.
- Spectroscopy.
- Electrochemistry.
- Photochemistry.
- Chemical kinetics.
- Quantum chemistry of molecular systems.

COMPETENCES / LEARNING OUTCOMES

DESCRIPTION OF CONTENTS

1. Study of an oscillating reaction: The Belousov-Zhabotinskii reaction.

The experiment shows the existence of oscillations in the concentration of some intermediate species involved in the reaction by using e.m.f. measurements. The formation of spatio-temporal figures is also shown and a model of the reaction mechanism that adequately reproduces the oscillations is analyzed.

2. Potentiometric and voltammetric study of the ferricyanide/ferrocyanide pair in aqueous potassium chloride

The electrochemical behavior of ferricyanide anion in potassium chloride solution is studied using linear scanning cyclic voltammetry and potentiometry techniques.

3. Fluorescence spectroscopy. Study of the effect of molecular structure on the fluorescent capacity of dyes and energy transfer of excited riboflavin molecules.

In the first part of the practical, the fluorescence, absorption and excitation spectra of a series of dyes of the same family are obtained and the fluorescence intensity is related to the molecular structure. In the second part, the energy transfer from an excited molecule (riboflavin) to an unexcited molecule (IK) is studied.

4. Kinetic study of the photochemical oxidation of triphenyl-phosphine.

Kinetic study of this photochemical reaction in organic medium by measuring the remaining triphenylphosphine fraction by reversed-phase HPLC chromatography.

5. Kinetic study of the reaction between iodine and acetone.

The rate law of the acid-catalyzed reaction between iodine and acetone is determined. The kinetics with respect to iodine is followed, determining its concentration by titrating reaction samples with thiosulfate. The orders with respect to acetone and acid are determined by performing the experiment for different concentrations of acetone and acid.

6. Quantum-chemical calculations: I-Geometric and electronic structures. II-Electronic spectra.

The practice introduces the main semi-empirical computational methods. The methods are applied to a set of representative molecules from the family of alkanes, alkenes and aromatic systems. In practice, the geometrical and electronic structure is studied and the absorption spectra are calculated.

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	30,00
Preparation of lessons	14,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The course will be developed through the following teaching methodologies:

- expository classes
- practical classes
- data processing, calculations and resolution of questions
- information gathering

Students will have in advance the scripts of each of the practicals, which can be downloaded from the web page of the teaching laboratories of the Department of Physical Chemistry. There you will find general information about how to work in the laboratory, didactic material and links of interest that can be consulted at any time.

The course includes 60 classroom hours distributed in 15 sessions of 4 hours each. There will be 6 practicals and 4 seminars, which will be dedicated to activities related to the acquisition of transversal competences.

The practicals are organized two by two, dedicating 4 sessions to each of the groups of two practicals according to the following scheme:
1st session: Explanation of the two practices.
2nd session: Performance of the first of the two practices.
3rd session: Performance of the second one.
4th session: Session of calculations and questions of all two practices in the computer classroom.

The six programmed practices will be carried out in ten sessions. Three more sessions will be dedicated to seminars.

The development of the course is structured around the following axes:

1.- Preparation of the practical.
Each practical has specific objectives that are specified in the text of the guide, as well as the necessary bibliography to prepare them. The students will have to study the content of the scripts before the beginning of each session, prepare an outline of the experimental procedure and carry out the preliminary questions and the necessary calculations to be able to carry out the experiment.

2.- Experimental work.
The experiments are done in pairs and in some cases the results obtained by different pairs are shared, which helps to enhance teamwork.
The elaboration of the workbook at the same time that the practical is carried out is an important part of the laboratory work.

3.- Treatment of the obtained results.
The treatment of results will begin in the laboratory. The student must not only calculate, but also analyze the experimental results obtained in the laboratory as well as the predicted calculations, and express the results with the appropriate units and significant figures. Therefore, this stage aims to develop the student's analytical skills.

4.- Laboratory workbook.
The student must keep the laboratory workbook up to date. The professor will periodically review this workbook, and the student will present it at the end of the course in the term established by the professor.

5.- Memoire of one of the experiments carried out.
One of the objectives of this course is that the student is familiar with the presentation of a scientific work, for this reason each student will present a report. This work will be elaborated individually and will be presented in the term established by the teacher. The professor will indicate to each student the report to be elaborated.

6.- Seminars
Students will be instructed in the search for bibliographic information and in the use of databases, in order to complete the experimental studies carried out. Likewise, students will solve doubts and analyze results and procedures of the practices carried out.

EVALUATION

Attendance to all practical sessions is mandatory. To pass the course the student will have to attend at least 90% of the laboratory sessions and seminars. The evaluation of learning will be individual and will be carried out according to the following criteria:

1. Continuous evaluation of each student, based on the classroom activities, participation and degree of involvement in the teaching-learning process during the laboratory sessions: attitude, acquired skills and laboratory notebook: 30% of the overall grade.

2. Written, oral and/or experimental exams: 40% of the global grade.

3. Presentation of the results obtained: reports, memoirs and/or oral communication: 30% of the overall grade.

FIRST CALL

The evaluation will be carried out by means of the weighted average of the three evaluation systems indicated. To pass the course, it is necessary to obtain an overall average grade of at least 5.0 and in addition, in each of the sections a minimum score of 4.0 points out of 10 must be achieved.

SECOND CALL

In the second call it will only be possible to recover the theoretical-practical tests and the presentation of the results, that is to say, the exam and the report.

The evaluation will be carried out following the weighting criteria indicated in the first call.

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will result in the impossibility of passing 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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