ENGLISH FRIENDLY COURSES (EFC) 2024-2025
CAMPUS OF GIPUZKOA

Contact: quimicas.internacional@ehu.eus

In addition to the general offer of courses taught in English, some Centers offer for incoming students English Friendly Courses (EFC): subjects taught in Spanish or Basque, in which the syllabus summary; lecturer tutoring, examinations and/or papers are available in English.

English Friendly Courses taught in SPANISH:

<table>
<thead>
<tr>
<th>COURSE</th>
<th>SEMESTER1</th>
<th>CREDITS</th>
<th>SCHEDULE2</th>
<th>LINK TO SYLLABUS</th>
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<td>Bachelor's Degree in Chemistry</td>
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<td>25115  Ingeniería Química</td>
<td>Annual</td>
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1 SEMESTER: Annual: September 2024 to May 2025
1st: September 2024 to January 2025
2nd: January 2025 to May 2025
2 SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30
### English Friendly Courses taught in BASQUE:

#### FACULTY OF CHEMISTRY (215)

<table>
<thead>
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<th>COURSE</th>
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3 SEMESTER: Annual: September 2024 to May 2025
   1st: September 2024 to January 2025
   2nd: January 2025 to May 2025

4 SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30
This subject introduces the students to the industrial aspects of Chemical Engineering and it gives them the basic knowledge and skills to analyze, design and operate basic equipment in the chemical industry. Contents include concepts such as basic operation, property balances and the mathematical modeling of chemical reactors.

The competences the student must acquire are:

- Capacity to apply the basic principles of Chemistry in the study of industrial chemical processes.
- Ability to present subjects in the chemical engineering area, in a comprehensible way.
- Capacity to search and select relevant information in the chemical and scientific fields, employing paper and electronic bibliography.
- Ability to relate the chemistry knowledge with other scientific fields and evaluate the impact of chemistry and the chemical industry in the modern world.

The Grade Coordination Commission will guarantee the coordination of this subject with the other ones within the Grade in Chemistry.

Theoretical and Practical Contents

1.- Introduction: Chemical engineering. Processes and operations in the chemical industry.

TEACHING METHODS

The subject includes on-site classes with the teacher and seminars where the student must solve and discuss problems on chemical engineering. In the first semester, Problem Based Learning will be implemented.

TYPES OF TEACHING

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<tr>
<th>Types of teaching</th>
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<th>GA</th>
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Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 50%
- Exercises, cases or problem sets 45%
- Teamwork assignments (problem solving, Project design) 5%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the subject will be done by written exams (50%) and by resolution of exercises carried out in groups (50%).

At the end of the first semester, a partial exam can be written. This exam will have a theoretical (50%) and a practical (50%) part. In order to make the average, a minimum mark of 3 should be obtained in each part. If this partial exam is passed, the subjects corresponding to this part will no be evaluated again in the final exam.

The final mark will be the average of the marks obtained in each semester, if a minimum of 4 has been obtained in the exam of each of them.
In order to obtain a "non-presented" mark, it is enough not to assist to the final exam. If the student wants to write a final exam with a value of 100% of the mark, it will have to be asked to the teacher before the 18th week of the course.

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Written exam with a value of 100%. This exam will have a theoretical (50%) and a practical (50%) part. In order to make the average, a minimum mark of 3 should be obtained in each part. If a student does not appear to this exam, a "non-presented" mark will be given.

**MANDATORY MATERIALS**

It will be said at the beginning of the course.

**BIBLIOGRAPHY**

**Basic bibliography**

- G. Calleja (Ed.): "Nueva introducción a la Ingeniería Química" (2 vol.). Ed. Síntesis (Madrid, 2016).

**Detailed bibliography**

- J.M. Coulson y J.F. Richardson: "Ingeniería Química (varios volúmenes)”. Ed. Reverté.

**Journals**

- Chemical Engineering Journal: https://www.journals.elsevier.com/chemical-engineering-journal
- Education for Chemical Engineers: https://www.journals.elsevier.com/education-for-chemical-engineers
- Chemical Engineering Educators: http://journals.fcla.edu/cee

**Web sites of interest**

- https://www.industriaquimica.es/
- http://www.chemengonline.com/

**OBSERVATIONS**
COURSE GUIDE 2024/25

Faculty 215 - Faculty of Chemistry
Degree GQUIMI20 - Bachelor's Degree in Chemistry

COURSE
26113 - Organic Chemistry I
Credits, ECTS: 9

COURSE DESCRIPTION
Basic concepts of Organic Chemistry, such as molecular structure and reactivity of the principal functional groups will be presented. This knowledge will be applied to the synthesis of structurally simple molecules.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
Basic structural features, and chemical and physical properties, of hydrocarbons and other families of organic compounds are covered along with an introduction to organic reactions mechanisms.

- The aim is that students develop basic competences as specified in RD 1393/2007 that correspond to the sophomore level. Also, the following transversal competences (Fundamental Module M02) will be acquired:
  - M02CM08: the ability to discern the appropriate instrumental technique, individual or combined, for the characterization of chemical substances.
  - M02CM09: the ability to present, orally and on written, chemical processes and phenomena in a clear and understandable manner.

Likewise, taking this subject should allow students to acquire the following competences specific to Organic Chemistry:

- M02CM02: to know the structure, properties, preparation methods and main reactivity patterns of chemical elements and compounds derived thereof, either organic or inorganic.
- M02CM03: the ability to plan and carry out simple processes of synthesis and characterization of compounds. To carry out chemical experiments in a reliable manner, using appropriate techniques, and monitoring the relevant observations and their correct interpretation.
- M02CM05: To understand the relationships between chemical structure, properties and processing of the different types of materials and their aftermath classification according to the applications sought.

The coordination, both horizontal and vertical, of the subject within the Module and the Degree will be supervised by the Commission of Coordination of the Degree.

Theoretical and Practical Contents
- The carbonyl group and derivatives. Aldehydes and ketones. Structure, obtaining and reactivity.

TEACHING METHODS
All teaching resources regarding the subject will be available on the web of UPV/EHU at the outset of the fall. Lectures will be combined with as many as possible face-to-face sessions devoted to exercises. Additional exercises and problems will be also provided for personal training. Doubts and questions will be solved individually during tutorial hours. Efforts will be directed to get as much direct student-teacher interaction as possible.

TYPES OF TEACHING

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Legend:
- M: Lecture-based
- S: Seminar
- GA: Applied classroom-based groups
- GL: Applied laboratory-based groups
- GO: Applied computer-based groups
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- TA: Workshop
- TI: Industrial workshop
- GCA: Applied fieldwork groups

Evaluation methods
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
A) GENERAL RULE
General Regulations adopted by UPV/EHU (BOPE of March, 2017) concerning the assessment of students achievement in the Degrees given by UPV/EHU will be applicable. For more information, see section 2 of such Regulations, articles 8, 9 and 12.

B) CONTINUOUS ASSESSMENT
Continuous assessment will be applied during the ordinary call only, with the following parts and percentages:

- 20% Two written exams covering parts of the subjects in progress.
- 80% Final written exam fully covering the subjects.

If someone does not make the exam, he or she will be rated cero. In case it is the Final exam, the ordinary call would get extinct.

To be eligible for averaging, a mark of 4.0 or higher must be obtained in the Final exam.

Students have the option to renounce a call by informing in writing the professor in charge of the subject. Requests need to be submitted before the fixed deadline, which will be not before one month in advance to the end of the lecturing period. Should this action be taken the subject will be rated as NOT PRESENTED (thee call will not get extinct).

C) ASSESSMENT BY SINGLE FINAL EXAMINATION
Assessment by a single examination is feasible only if a renounce to the continuous assessment has been submitted by the student on time. Requests need to be submitted in writing to the professor in charge of the subject during the first 18 weeks of regular lecturing period.

The single Final examination will account for 100% of the grading.

If someone does not make the Final exam, the grading will be NOT PRESENTED and the call will not get extinct.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT
Special call will consist of a single Final Examination which will account for 100% of the grading.

If someone does not make such a Final Exam, the grading will be NOT PRESENTED and the call will not get extinct.

MANDATORY MATERIALS
At least one book among the basic titles listed below is highly recommended. The professor in charge of the subject will give additional directions.

BIBLIOGRAPHY

Basic bibliography

Detailed bibliography

Journals
Organic Letters: http://pubs.acs.org/journal/orlef7
Organic and Biomolecular Chemistry: http://www.rsc.org/Publishing/Journals/Ob/Index.asp
The Journal of Chemical Education: http://jchemed.chem.wisc.edu/

**Web sites of interest**

Organic Resources Worldwide: http://www.organicworldwide.net/
Grupo especializado de química orgánica de la RSEQ: http://www.ucm.es/info/rsequim/geqo/
Chemical and Engineering News: http://www.ucm.es/info/rsequim/geqo/
Blog de Química: http://elblogdeuhogris.blogspot.com/

**OBSERVATIONS**
COURSE GUIDE 2024/25

Faculty 215 - Faculty of Chemistry
Degree GQUIMI20 - Bachelor's Degree in Chemistry

COURSE
26114 - Organic Chemistry II Credits, ECTS: 9

COURSE DESCRIPTION
In this course, students will deepen their knowledge of organic chemistry through the study of modern methods of organic synthesis, general reactions and their specific versions, and their application to the synthesis of organic compounds. The course includes an experimentation laboratory in Organic Chemistry, oriented to the planning and execution of the synthesis of simple organic molecules.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
The objectives of the course are as follows:

1) Know the structural characteristics and the symmetry and stereochemistry of organic compounds.

2) Become familiar with modern methods of organic synthesis, including specific reactions and versions.

3) Know the most important reaction mechanisms, considering aspects of chemo- and stereoselectivity.

4) Be able to propose short syntheses of simple compounds.

The aim is for the student to develop the basic and general competences defined in the RD1393/2007 for this level in the field of Chemistry as well as the following transversal competences (Fundamental Module M02):

-- M02MC08: Ability to select different instrumental techniques, simple or combined, for the characterisation of chemical substances.

-- M02MC09: To be able to present orally and in writing, in an understandable way, phenomena and processes related to Chemistry and related subjects.

-- M02MC10: Ability to search for and select information in the field of Chemistry and other scientific fields, making use of the bibliography.

-- M02CM11: Being able to relate Chemistry to other disciplines, as well as to understand its impact on today’s society and the importance of the industrial chemical sector.

Successful completion of the course should also enable the student to acquire the following specific competences (Modules M01 and M02):

-- M01CM03: Safe use of the usual laboratory means and techniques.

-- M01CM05: Ability to observe, analyse and present results in the field of chemistry and other sciences.

-- M02CM02: Knowledge of the structure, properties, methods of preparation and the most important chemical reactions of the chemical elements and their compounds.

-- M02CM03: Ability to plan and carry out in the laboratory simple processes of synthesis and characterisation of chemical compounds, safely and using the most appropriate techniques, as well as to evaluate and interpret data derived from experimental observations.

The horizontal and vertical coordination of the subject in the Module and in the Degree will be ensured by the Commission of Coordination of the Degree

Theoretical and Practical Contents

Basic principles. Chirality. Stereogenic elements. Structural determination of the absolute and relative relative configuration. Conformational analysis Prochirality and topicity Stereoselective reactions.


- Oxidations
- Reductions

**TEACHING METHODS**

Delivery of general content. Lectures supported by multimedia elements (Power Point presentations, videos, web pages) and other types of teaching material (molecular models).

**TYPES OF TEACHING**

<table>
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<tr>
<th>Types of teaching</th>
<th>M</th>
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**Evaluation methods**

- Continuous evaluation
- End-of-course evaluation

**Evaluation tools and percentages of final mark**

- Written test, open questions  70%
- Exercises, cases or problem sets  30%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Evaluation methods and percentage in the final mark:

Mixed evaluation:

- 20% Partial written exams
- 50% Final written exam.
- 10% Seminars.
- 20% Laboratory practices.

1- To pass the course it is necessary to obtain a minimum mark of 4.0 in the final exam and to pass the laboratory practices.

2- The non-completion of the partial exam and seminars (or their presentation after the deadline) will imply a zero for said test. Failure to submit to the final written exam will suffice to be qualified NOT PRESENTED (no call is required), regardless of whether the partial exam or seminars have been taken.

3- The mark obtained in the partial exam and the seminars is only valid for the first call. In case of failing the first call, the second call will only be evaluated as a single exam with 80% of the grade.

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

- 80% Final written exam.
- 20% Laboratory practices.

1- To pass the subject it is necessary to obtain a minimum grade of 5.0 in the final exam and to pass the laboratory practices.

2- Failure to submit to the final written exam will suffice to be qualified NOT PRESENTED (no call is required).
MANDATORY MATERIALS
As indicated by the teacher and at least one text from the basic bibliography. Personal laboratory equipment, especially lab coat, safety goggles, spatula and latex gloves.

BIBLIOGRAPHY

Basic bibliography
Structure, symmetry and stereochemistry:


Organic reactions. Reactivity and mechanisms:

7. D. Klein, Química Orgánica, Ed. Panamericana, 2014

Detailed bibliography


Journals
Organic Syntheses: http://www.orgsyn.org/
Organic Letters: http://pubs.acs.org/journal/orlef7
Organic and Biomolecular Chemistry: http://www.rsc.org/Publishing/Journals/Ob/Index.asp
The Journal of Chemical Education: http://jchemed.chem.wisc.edu/

Web sites of interest
Organic Resources Worldwide: http://www.organicworldwide.net/

OBSERVATIONS
In this subject the knowledge in the area of Inorganic Chemistry is deepened through the Coordination Chemistry and the Organometallic Chemistry. Furthermore, the basics of Inorganic Solids Chemistry are introduced.

Students will acquire the basic skills defined in RD 1393/2007 for Chemistry, and the general skills for the Fundamental Unit. Furthermore, the more specific skills related to Inorganic Chemistry such as the bonding in coordination and organometallics, structure and most important reactions, thermodynamic, kinetic and application aspects will be developed. The student will also be able to understand the structure, reactivity and properties of inorganic solids and to determine them by the use of instrumental characterization.

M02CM02 - Possess knowledge of the structure, properties, preparation methods and the most important chemical reactions of the chemical elements and their organic and inorganic compounds.

M02CM03 - Possess the capacity to plan and perform simple laboratory processes for the synthesis and characterization of chemical compounds safely and using appropriate techniques, as well as to evaluate and interpret the data returned from experimental observations in the various fields of chemistry.

M02CM04 - Possess knowledge of the analytical process and the various stages involved and be able to plan, apply and process the most appropriate analytical methods in each specific case.

M02CM05 - Understand the relationships between the structure, properties and processing of the various types of materials and their selection according to each application.

The Degree Coordination Committee will guarantee horizontal and vertical coordination of the course both in the Unit and in the Degree.

**Theoretical and Practical Contents**

Coordination compounds. Structure and bonding.


**TEACHING METHODS**

The evaluation will be done as follows:
- Written exam corresponding to the theoretical part (it can be divided in several parts): 70% of the final mark.
- Continuous evaluation of the laboratory work (notebook, reports, work, results, test type exam): 20% of the final mark.
- Directed academic activities (solving of questions, preparation of reports, dissertations&#8230;): 10% of the final mark.

Remarks:
The minimum mark required in the exams is 4.0 (over 10)
The assistance to the laboratory is compulsory.

**TYPES OF TEACHING**

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
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Legend: 
M: Lecture-based           S: Seminar           GA: Applied classroom-based groups
TA: Workshop                  TI: Industrial workshop            GCA: Applied fieldwork groups
Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 70%
- Exercises, cases or problem sets 10%
- Prácticas de laboratorio 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation will be done as follows:
- Written exam corresponding to the theoretical part (it can be divided in several parts): 70% of the final mark.
- Continuous evaluation of the laboratory work (notebook, reports, work, results, test type exam): 20% of the final mark.
- Directed academic activities (solving of questions, preparation of reports, dissertations...): 10% of the final mark.

Remarks:
The minimum mark required in the exams is 4.0 (over 10)
The assistance to the laboratory is compulsory.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation will be done as follows:
- Written exam corresponding to the theoretical part: 80% of the final mark. (A minimum of 4.0 is required in this field)
- Evaluation of the laboratory work (notebook, reports, work, results, test type exam): 20% of the final mark. (A minimum of 4.0 is required in this field)

Remarks:
The mark "non presented" will be given to those students non taking the final exam.

MANDATORY MATERIALS


BIBLIOGRAPHY

Basic bibliography

Detailed bibliography

Journals
- Inorganic Chemistry, ACS Publications
- Dalton Transactions, The Royal Society of Chemistry
- European Journal of Inorganic Chemistry, Wiley
- Inorganica Chimica Acta, Elsevier
- Polyhedron, Elsevier
- Inorganic Syntheses, Wiley
- The Journal of Chemical Education, ACS Publications
Web sites of interest
It will be indicated each year.
COURSE GUIDE 2024/25

<table>
<thead>
<tr>
<th>Faculty</th>
<th>215 - Faculty of Chemistry</th>
<th>Cycle</th>
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<tr>
<td>Degree</td>
<td>GQUIM20 - Bachelor's Degree in Chemistry</td>
<td>Year</td>
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COURSE

26127 - Analytical Chemistry I

Credits, ECTS: 9

COURSE DESCRIPTION

As it is the first subject of the Analytical Chemistry area that the student will follow, its main goal is to introduce the analytical process from a global point of view, starting from the sampling design, following with the real sampling and the analysis and ending with the evaluation of the results. A special importance will be given to the sampling and sample treatment, separation methods (non chromatographic ones), and to the application of chemical analytic methods (volumetry and gravimetry). In addition, some lab practices have been included to help understanding the basic operations of this topic.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

M02CM04 - Possess knowledge of the analytical process and the various stages involved and be able to plan, apply and process the most appropriate analytical methods in each specific case.
M02CM08 - Be able to select different simple or combined instrumental techniques for the characterisation of chemical substances.
M02CM09 - Be able to make verbal and written presentations of phenomena and processes related to chemistry and similar subjects in a comprehensible way.
M02CM10 - Be able to search for and select information in the field of chemistry and other sciences through the use of the literature and information technologies.

Theoretical and Practical Contents


Liquid-liquid extraction. Organic solvents. Equilibrium distribution and efficacy. Metallic chelants extraction.


TEACHING METHODS

The cronogram of the unit will be explained at the beginning of the course. The lectures hours and the data of the practical laboratory are available at the Faculty website.

TYPES OF TEACHING

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<th>Types of teaching</th>
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</table>

Legend:
- M: Lecture-based
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Evaluation methods
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Written test, open questions  60%
- Exercises, cases or problem sets  20%
- Oral presentation of assigned tasks, Reading   10%
- Computer based practices and problems solving  10%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

The ordinary evaluation will be divided in the terms presented in the table above.

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Same criteria as in the ordinary evaluation.

**MANDATORY MATERIALS**


**BIBLIOGRAPHY**

**Basic bibliography**


**Detailed bibliography**


**Journals**


**Web sites of interest**

http://www.asdlib.org

**OBSERVATIONS**

Final evaluation system can be used by the students that cannot make the continuous modality. It will consist in the three tests that have been presented before, and they will produce 100% of the mark.
COURSE GUIDE 2024/25

Faculty: 215 - Faculty of Chemistry
Degree: GQUIMI20 - Bachelor's Degree in Chemistry
Cycle: 
Year: Third year

COURSE

26128 - Analytical Chemistry II
Credits, ECTS: 9

COURSE DESCRIPTION

This subject deals with instrumental analysis concepts and contents, the basis of the instruments functioning and instrumental techniques classification. Students are trained in methods of standardization and univariate calibration. Finally, and more in detail, the following instrumental techniques are described: spectroscopic, chromatographic and electroanalytic techniques.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The specific M02CM04 skill and cross-skills M02CM08, M02CM09 and M02CM10 are developing.
M02CM04 - Possess knowledge of the analytical process and the various stages involved and be able to plan, apply and process the most appropriate analytical methods in each specific case.
M02CM08 - Be able to select different simple or combined instrumental techniques for the characterisation of chemical substances.
M02CM09 - Be able to make verbal and written presentations of phenomena and processes related to chemistry and similar subjects in a comprehensible way.
M02CM10 - Be able to search for and select information in the field of chemistry and other sciences through the use of the literature and information technologies.

Vertical and horizontal coordination of the subject in the module and the Bachelor's Degree corresponds to the Bachelor's Degree coordination commission.

Theoretical and Practical Contents

1. Instrumental data treatment
   OPTICAL METHODS
   2. Fundamentals of optical methods
   3. Spectrophotometry
   4. Spectrofluorimetry
   5. Turbidimetry and nephelometry
   6. Atomic spectroscopy
   CHROMATOGRAPHIC AND ELECTROPHORETIC METHODS
   7. Fundamentals of chromatography
   8. Gas chromatography (GC).
   9. Liquid chromatography (HPLC).
   10. Capillary electrophoresis
   ELECTROCHEMICAL METHODS
   11. Potentiometry
   12. Methods based on electrochemistry

TEACHING METHODS

Lessons consist of:
   a. Explanation of theory and exercises. In some cases, a computer is used.
   b. Realization of exercises and works by students, in groups or individually. In some cases, a computer is used.
   c. Oral presentation of a work.

TYPES OF TEACHING

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<tr>
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Evaluation methods
- Continuous evaluation
Evaluation tools and percentages of final mark

- Written test, open questions  79%
- Otros  21%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

CONTINUOUS EVALUATION:
It is necessary to participate in all parts in which the subject is divided.
It is mandatory to attend all the classes in the computers room.
Marks below 5.0 out of 10.0 can not be compensated.
It is necessary that the mark is compensated among the questions in theory and problems in order to pass the exam. A cut-off mark of 3.0 is applied.
Marks among first and second mid-term have to be compensated in order to pass the exam. A minimum mark of 5.0 is necessary in each part.
Students under continuous evaluation can refuse exam call at any time until a month before the ending of the classes by a writing addressed to the teacher. Otherwise, students are having a failing grade in the subject even though they are not attending the exam. These criteria are specified in chapter 2, article 12 of the EHU Bachelor's Degree students evaluation regulation.

FINAL EVALUATION:
A final proof able to evaluate of the skills to be acquired in the subject is given. All the individual parts of the proof should be passed.
To be evaluated by an unique final proof, students have a period of 18 weeks from the beginning of the course to ask for this option. Criteria to refuse to the continuous evaluation are established in chapter 2, article 12 of the EHU Bachelor's Degree students evaluation regulation.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary call consists of a final proof. Anyway, positive partial results obtained in the ordinary call can be saved.

MANDATORY MATERIALS

Consult the student guide.

BIBLIOGRAPHY

Basic bibliography


Detailed bibliography


Journals
Web sites of interest
http://www.asdlib.org
http://www.chromacademy.com/
COURSE GUIDE 2024/25

Faculty: 215 - Faculty of Chemistry
Degree: GQUIM20 - Bachelor's Degree in Chemistry
Cycle: 
Year: Fourth year

COURSE
26131 - Projects in Industrial Chemistry
Credits, ECTS: 6

COURSE DESCRIPTION
This subject is an introduction to the Chemical Industry and presents the concepts and tools employed in this sector to the student. The content includes a description of the steps for the design, management and development of chemical engineering industrial projects and a survey of the chemical industry. Finally, an introduction to the principles of chemical process safety is given.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
The competences the student must acquire are:
M02CM07 - Possess the ability to apply the basic principles of chemistry to industrial chemical operations and carry out chemical installation projects.
M02CM09 - Be able to make verbal and written presentations of phenomena and processes related to chemistry and similar subjects in a comprehensible way.
M02CM10 - Be able to search for and select information in the field of chemistry and other sciences through the use of the literature and information technologies.
M02CM11 - Be able to relate chemistry with other disciplines and understand its impact on today's society and the importance of the industrial chemical sector.

The Grade Coordination Commission will guarantee the coordination of this and other subjects within the Grade in Chemistry.

Theoretical and Practical Contents


Chemical Process Safety: Accidents, Toxicology, Fire and Explosions.

TEACHING METHODS
The subject combines on-site classes with seminars where the student must solve and discuss problems and perform the several tasks proposed during the course.

TYPES OF TEACHING

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Evaluation methods
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Written test, open questions 55%
- Exercises, cases or problem sets 37%
- Oral presentation of assigned tasks, Reading 8%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT
The subject will be evaluated through written exams (55%) and assignments (45%). The written exams, in which the skills M02CM07 and M02CM011 will be assessed, will be divided into a midterm exam and a final exam. They will be written tests related to the concepts developed in the whole of the subject. The midterm exam will take place at the end of the first semester and passing it will mean the elimination of the corresponding subject for the final exam. To be able to take an average between the partial exams, you must obtain at least 4 in the final exam. The work carried out during the course will be evaluated through written controls or online questionnaires, evaluating the competencies M02CM09, M02CM10 and M02CM11.
Students have the right to be evaluated through the final evaluation system (single test), regardless of whether or not they have participated in the continuous assessment system. To do this, students must submit, within a period of 9 weeks from the beginning of the course, a letter to the teacher responsible for the subject, declining the continuous assessment.

It will be enough for the student not to take the exam to be evaluated as "not presented".

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

- **Written exam:** 100%
- It will be enough for the student not to take the exam to be evaluated as "not presented".

### MANDATORY MATERIALS

Se indicará cada curso en la Guía Docente.

### BIBLIOGRAPHY

#### Basic bibliography


#### Detailed bibliography


#### Journals

A list will be distributed every course.

#### Web sites of interest

http://www.essentialchemicalindustry.org/chemicals.html

### OBSERVATIONS
This is an applied subject and its main goal is to develop the student’s ability to investigate in literature on a specific analytical problem and to identify, evaluate and propose analytical solutions to the problem.

During the first part of the course, the student will receive a global vision on the applications of analytical chemistry in Biosciences regarding needs of society, ways of approaching the sample, most common instrumental techniques and future challenges.

The students will dedicate the second part of the course to solving a specific analytical problem through a bibliographic search. This searching process will be discussed and evaluated along the academic year in different seminars.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

M03CM06 - Be able to understand the nature of an analytical problem, investigate it in the literature and identify, assess and present analytical solutions.

M03CM11 - Be able to design, programme and carry out experimental processes and use adequate instrumental techniques for different types of chemical problems.

M03CM12 - Possess knowledge of the network tools and services that enable searches for information in the field of chemistry and similar fields.

M03CM14 - Be able to use the information and knowledge gained from the module for training in existing or emerging fields related to chemistry.

M03CM16 - Employ advanced mathematical techniques to consider and resolve matters related to chemistry (data-processing, modelling, etc.).

M03CM17 - Demonstrate observation, analysis and synthesis skills with a capacity for criticism and self-criticism.

M03CM18 - Demonstrate a capacity for learning and for autonomous work for professional development.

M03CM19 - Be able to manage, organise and plan chemical processes, applying criteria of quality and environmental conservation.

M03CM20 - Relate chemistry with other disciplines and understand its impact on the industrial and technological society and the importance of the industrial chemical sector.

Theoretical and Practical Contents

1. Introduction. The analytical process
2. Application fields of analytical chemistry
3. Food analysis
4. Pharmaceutical analysis
5. Clinical analysis
6. Forensic analysis
7. Environmental analysis
8. Applied chemometrics

TEACHING METHODS

Classroom time will be divided in:
> Master classes: lectures on advanced analytical techniques not explained in previous analytical chemistry courses like immunoassays, biosensors, LC-MS or Raman Spectroscopy.
> Computer classes: introduction to chemometrics. Hands on learning using the The Unscrambler (Camo) software for multivariate data analysis.
> Seminars: introduction will be given to general aspects of applied analysis in Biosciences fields like food analysis, forensic analysis or pharmaceutical analysis. Next, the teacher will propose specific analytical problems that students will solve in groups using scientific literature. Finally, a written report will be written and an oral presentation will be given in final seminar. The data for this final presentation will be decided depending on the number of students and groups.

TYPES OF TEACHING

<table>
<thead>
<tr>
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**Evaluation methods**

- Continuous evaluation
- End-of-course evaluation

**Evaluation tools and percentages of final mark**

- Written test, open questions 55%
- Exercises, cases or problem sets 25%
- Teamwork assignments (problem solving, Project design) 15%
- Oral presentation of assigned tasks, Reading 5%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

1) To pass the course, a minimum grade of four will be required in the written exam.

2) Failure to make the report of the research work and/or the oral presentation (or to do it after the deadline) will suppose a zero in the corresponding sections.

3) In accordance with the regulations for the evaluation of undergraduate students of the UPV/EHU, students are entitled to be evaluated through the final evaluation system, regardless of whether or not they have participated in the continuous assessment system. To do this, students must send in writing to the teacher responsible for the subject, the waiver of continuous assessment before 18th week of the academic year, in accordance with the academic calendar of the center.

4) The resignation to the call will mean the qualification of "not presented". In the case of continuous evaluation, students can waive the call in a period that, at least, will be up to one month before the end date of the teaching period of the corresponding subject (week 26 in the teaching calendar). This waiver must be submitted in writing to the teacher responsible for the subject.

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

1) Students who do not pass the subject in the ordinary call, regardless of the evaluation system taken, will have the right to present themselves to the exams and evaluation activities that make up the final evaluation test of the extraordinary call.

2) The evaluation in the extraordinary call will be done exclusively through the final evaluation system. The final evaluation test of the extraordinary call will consist on as many exams and evaluation activities necessary to evaluate and measure the defined learning results, in a way comparable to how they were evaluated in the ordinary call. However, the positive marks obtained by students during continuous evaluation will be kept for the extraordinary call.

3) In the case of having obtained negative results in the continuous assessment carried out during the course, these results cannot be maintained for the extraordinary call. In these cases, the students will be able to obtain 100% of the grade through the final evaluation.

**MANDATORY MATERIALS**

Se indicará cada curso en la Guía Docente.

**BIBLIOGRAPHY**

**Basic bibliography**


S. Bell, Forensic Chemistry. Pearson (New Jersey, 2006).


**Detailed bibliography**


R.A. Meyers (Editor), Encyclopedia of Analytical Chemistry. Wiley & Sons (Chichester, UK, 2000).

Journals

Web sites of interest

OBSERVATIONS
COURSE GUIDE 2024/25

Faculty: 215 - Faculty of Chemistry

Degree: GQUIM20 - Bachelor's Degree in Chemistry

Cycle: 

Year: Fourth year

COURSE

26139 - Environmental Technology & Chemistry

Credits, ECTS: 6

COURSE DESCRIPTION

In this subject the student must apply his knowledge of Chemistry to the understanding of the environment, its processes and the fate and effects of chemical compound releases. In addition, the student will employ Chemical Engineering principles for the selection and design of waste treatment plants.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The competences the student must acquire are:

- M03CM08 - Know how to integrate their knowledge of chemistry and chemical engineering to evaluate the impact and evolution of pollutants in the environment and implement the different means of purification.
- M03CM12 - Possess knowledge of the network tools and services that enable searches for information in the field of chemistry and similar fields.
- M03CM13 - Transmit phenomena and processes related to chemistry and similar fields in verbal presentations and/or written reports and in a comprehensible way in either of the two official languages of the Autonomous Community of the Basque Country or in English.
- M03CM17 - Demonstrate observation, analysis and synthesis skills with a capacity for criticism and self-criticism.
- M03CM18 - Demonstrate a capacity for learning and for autonomous work for professional development.
- M03CM19 - Be able to manage, organise and plan chemical processes, applying criteria of quality and environmental conservation.
- M03CM20 - Relate chemistry with other disciplines and understand its impact on the industrial and technological society and the importance of the industrial chemical sector.

At the end of the course, the student is expected to be able to:

- Explain the characteristics of the environment and environmental processes using chemical arguments.
- Analyze environmental quality data
- Describe the evolution and effects of pollutants in the environment
- Reason and suggest treatment systems for waste streams.

Theoretical and Practical Contents

I/Natural Environment.
II/Atmosphere
III/ Hydrosphere
IV/ Waste Water treatment.
III/ Soil and soil pollution.

TEACHING METHODS

The subject includes on-site classes with the teacher and seminars where the student must

a) solve and discuss environmental problems
b) prepare and make a presentation on a subject related with the environment.

TYPES OF TEACHING

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<tr>
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Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Written test, open questions 60%
- Oral defense 10%
- Individual assignments 20%
- Oral presentation of assigned tasks, Reading 10%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

- Continuous evaluation system (Practical activities plus written test)
- Final evaluation

Evaluation guidelines:
* Written exam: 60%
* Debate: 10%
  * Written report and presentation 20%
  * Solving and discussing environmental problems 10%

Students have the right to be evaluated through the final evaluation system (single test), regardless of whether or not they have participated in the continuous assessment system. To do this, students must submit, within a period of 9 weeks from the beginning of the course, a letter to the teacher responsible for the subject, declining the continuous assessment. It will be enough for the student not to take the exam to be evaluated as "not presented".

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Written exam: 100%
It will be enough for the student not to take the exam to be evaluated as "not presented".

**MANDATORY MATERIALS**

No hay material obligatorio

**BIBLIOGRAPHY**

Basic bibliography

Detailed bibliography

Journals
Environmental Science and Tecnology
Environmental Science: Advances
COMMUNICATIONS EARTH & ENVIRONMENT
Nature Climate Change
One Earth

Web sites of interest
https://climate.nasa.gov/

**OBSERVATIONS**
COURSE GUIDE 2024/25

Faculty 215 - Faculty of Chemistry
Degree GQUIM20 - Bachelor's Degree in Chemistry

COURSE
26130 - Applied Biological Chemistry
Credits, ECTS: 6

COURSE DESCRIPTION
The subject is part of the Bioscience specialty of the Degree that corresponds to the Advanced Module. This specialty relies on the Chemistry knowledge related to Biosciences, such as, Biochemistry and Biology. The main objective of this course is to prepare the students to be part of multidisciplinary research groups.

In this course, students will learn concepts, methods and terms related to Biomedicine and Molecular Biology in order to understand the relevance of Chemistry in these fields and the role a Chemist can have in these research areas.

Knowledge will also be acquired through discussions and exercises that broaden the ability of the students to search for specialized information in other fields of knowledge different from Chemistry.

The subject starts from basic knowledge of Genetic Engineering; thus, basic biology knowledge (DNA, RNA, protein and cell structures, for instance) is considered enough to follow the course properly. Nonetheless, having passed Biology (1st year) and Biochemistry (2nd year) subjects is highly recommended.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
The subject is part of the Bioscience specialty of the Degree that corresponds to the Advanced Module and, as such, shares the transversal competences assigned to this module.

More specifically, this course develops the skills M03CM17, M03CM18 and M03CM20 transversal competencies and M03CM9, M03CM12, M03CM13 general competencies.

M03CM9 - Know the mechanisms and functions of relevant Biological Systems for Modern Chemistry.
M03CM12 - Possess knowledge of network tools and services that enable searches for information in the field of chemistry and similar fields.
M03CM13 - Explain phenomena and processes related to chemistry and similar fields in oral presentations and/or written reports and in a comprehensible way in either of the two official languages of the Basque Country or in English.
M03CM17 - Demonstrate observation, analysis and synthesis skills with a capacity for criticism and self-criticism.
M03CM18 - Demonstrate a capacity for learning and for autonomous work for professional development.
M03CM19 - Be able to manage, organize and plan chemical processes, applying criteria of quality and environmental conservation.
M03CM20 - Relate chemistry with other disciplines and understand its impact on the industrial and technological society and the importance of the industrial chemical sector.

The coordination of this subject with the rest of the Module corresponds to the Coordination Commission of the Degree in Chemistry.

Theoretical and Practical Contents
Theoretical content related to lectures is outlined below (acquired competences M03CM09, M03CM13, M03CM17 and M03CM20):

1. Introduction to Biotechnology.
2. Gene manipulation techniques and their relevance.
3. Cloning vectors.
4. DNA extraction.
5. Enzymes for DNA manipulation.
7. Vector designing.
8. Check-points for the cloning process.
11. Introduction to Medical Chemistry.

The rest of the theoretical contents will be selected by the students to perform an oral presentation. The possible topics are (among other topics related to Biochemistry, Biotechnology or Biology):

1. Hormones and signal transduction.
2. Antibiotics and druggability.
3. Cancer and mechanisms of antitumoral drugs.
5. Nervous system and neurotransmitters.
6. Immune system.
7. Cell proliferation.
8. Model organisms.
10. RNA-sequencing and ribosome profiling.

In Laboratory sessions (15 h, competences M03CM09, M03CM13, M03CM15, M03CM17 and M03CM18) the students will perform experimental processes explained in lectures (PCR, transformation, &#8230;) that are required to delete a gene from the genome of a cell culture.

**TEACHING METHODS**

For theoretical content of the course, the methodology will consist of the presentation of the subject through lectures. The lectures will be conducted using a dynamic and cooperative method that consists of starting every topic with a structural problem in order to activate student's curiosity and previous knowledge. Then, theoretical content will be presented and at the end of the topic, the students will be challenged to solve different scenarios and problems in groups. Then, students will present their results and conclusions in an oral presentation in front of the rest of the class. The lecturer will evaluate and advise the students to correct misunderstandings and gradually improve their skills. Finally, correct development of the learning process will be evaluated using test questions and correct answers of the test will be discussed with all students.

Tutoring sessions will be used to answer individual questions. Students will also prepare an oral presentation (1 h). The main objective of these sessions is to develop student's autonomous work, improve their communication skills and enhance their knowledge of a topic of their choice in the table of contents of the subject. Students will be divided into groups and they will autonomously (but with the support of the teacher) prepare the presentation applying their criteria in searching, analyzing and synthesizing the information. At the end of the course, students will present their work in an oral presentation in front of the rest of the class. The lecturer will evaluate and advise the students to correct misunderstandings and improve their skills.

Practical laboratory work will be carried out in 3-4-hour sessions in the afternoons. In these sessions, students will learn some standard procedures and protocols related to the theoretical content of the subject. Furthermore, during these sessions some problems will be proposed and solved so that they will be able to solve other problems in the future.

**TYPES OF TEACHING**

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**Evaluation methods**
- Continuous evaluation
- End-of-course evaluation

**Evaluation tools and percentages of final mark**
- Written test, open questions 60%
- Exercises, cases or problem sets 10%
- Oral presentation of assigned tasks, Reading 30%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Evaluation methods:
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Written test, open questions 60%
- Exercises, cases or problem sets (laboratory notebook) 10%
- Oral presentation of assigned tasks, 30%

In order to ensure an integral learning process a minimum of 45% of the maximum qualification will be compulsory in every evaluation tool.

Ordinary Evaluation: evaluation of theoretical-practical and laboratory activities.
Evaluation of the theoretical contents will be through a final exam on all the subjects. Written tests will represent 60% of the final mark. In the written test, students are requested to answer questions with acquired knowledge, reasoning and with correct use of scientific language and vocabulary.

Assessment of seminars (oral presentations) and work proposed: each student will make an oral presentation on a theme of the theoretical content proposed by the students. Along with the theoretical content of the presentation, communication skills, supporting multimedia resources and corporal expression will be assessed. The oral presentation will represent 30% of the final mark.

Evaluation of laboratory sessions will be through evaluation of the student’s aptitude and the laboratory notebook written individually by the students. This part will represent 10% of the final mark.

If the students do not attend the exam, it will be graded as not sat.

A request for evaluation, through a single test or a final evaluation, will be sent to the teaching staff within 9 weeks of the start of the term or course, in accordance with the content of chapter 2, article 8 of the Regulations governing student evaluation in undergraduate degrees of the UPV/EHU. This will consist of an examination on all the theoretical-practical content of the subject.

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

This will consist of an examination on all the theoretical-practical content of the subject.

### MANDATORY MATERIALS

The use of the platform eGela will be mandatory.

### BIBLIOGRAPHY

**Basic bibliography**

**Detailed bibliography**
- This will be given at the beginning of the course.

**Journals**
- Nature: http://www.nature.com/
- Science: http://www.sciencemag.org/
- Cell: http://www.cell.com/
- Plos: https://www.plos.org/iko da.

**Web sites of interest**
- Adieraziko da.
In this course studies on catalytic reactions useful for the transformation of organic compounds under homogeneous reaction conditions will be developed. Organometallic complexes will be used as catalysts and examples of asymmetric catalytic reactions of interest in the preparation of medicinals will be included. The student will acquire knowledge on the importance of organometallic complexes on biological systems and on medical treatments.

Students will acquire cross-skills corresponding to the Advanced Unit: Demonstrate observation, analysis and synthesis skills with a capacity for criticism and self-criticism; demonstrate a capacity for learning and for autonomous work for professional development; be able to manage, organise and plan chemical processes, applying criteria of quality and environmental conservation; relate chemistry with other disciplines and understand its impact on the industrial and technological society and the importance of the industrial chemical sector ([M03.CM17] to [M03.CM20]). Students will also reach more specific skills related to the knowledge of the main reactions that organometallic complexes may undergo, in special those involved in catalytic processes. Special interest will be devoted to industrial applications related to health, both from theoretical and experimental points of view. [M03.CM07], [M03.CM12] to [M03.CM14] (Understand the functioning and importance of homogeneous catalytic processes and their role in obtaining drugs and the biomedical applications of organometallic compounds. Possess knowledge of the network tools and services that enable searches for information in the field of chemistry and similar fields. Transmit phenomena and processes related to chemistry and similar fields in verbal presentations and/or written reports and in a comprehensible way in either of the two official languages of the Autonomous Community of the Basque Country or in English. Be able to use the information and knowledge gained from the module for training in existing or emerging fields related to chemistry)

The Degree Coordination Committee will guarantee horizontal and vertical coordination of the course both in the Unit and in the Degree.

Theoretical and Practical Contents


TEACHING METHODS

The methodology includes conferences, seminars and laboratory work. Personalized tutorials will also be available.

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
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<td>Hours of face-to-face teaching</td>
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Legend: M: Lecture-based | S: Seminar | GA: Applied classroom-based groups
TA: Workshop | TI: Industrial workshop | GCA: Applied fieldwork groups

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Written test, open questions 75%
- Laboratory work 25%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Theory 75 %. Minimum required 40 %.
Laboratory 25 %. Minimum required 40 %

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

Theory 75 %. Minimum required 40 %.
Laboratory 25 %. Minimum required 40 %

**MANDATORY MATERIALS**

Se indicará cada curso en la Guía Docente.

**BIBLIOGRAPHY**

**Basic bibliography**

**Detailed bibliography**

**Journals**
- Applied Organometallic Chemistry, Wiley
- Journal of Molecular Catalysis A: Chemical, Elsevier
- Journal of Molecular Catalysis B: Enzymatic, Elsevier
- Journal of Organometallic Chemistry, Elsevier
- Organometallics, ACS Publications

**Web sites of interest**

Se indicará cada curso en la Guía Docente.
# Physical Chemistry I

Physical Chemistry I provides the students the necessary knowledge to analyze the macroscopic behaviour of matter in terms of Thermochemistry, Kinetics or Electrochemistry. Furthermore, it will allow them to understand the fundamentals and applications of transport and surface phenomena, and complex systems as macromolecules and colloids. Overall, the contents of the subject will reveal the importance of physical chemistry in all the different areas of Chemistry, as well as its impact in the industry and technology-based society we live in.

The course is part of the Fundamental Module of the Chemistry Degree, and it is very closely related to the experimental course Experimental Physical Chemistry. The coordination of this course within the Physical Chemistry Module corresponds to the Chemistry Degree Coordination Comission, designated by the Faculty Council.

## Competencies/Learning Results for the Subject

Physical Chemistry I, as part of the Fundamental Module, shares the cross skills [M02CM09], [M02CM10] and [M02CM11] with the other courses of the same module. Besides, this course will also develop the specific skill [M02CM01].

- **M02CM01**: Understand and know how to apply the principles of physical chemistry and how they affect chemical processes.
- **M02CM09**: Be able to make verbal and written presentations of phenomena and processes related to chemistry and similar subjects in a comprehensible way.
- **M02CM10**: Be able to search for and select information in the field of chemistry and other sciences through the use of the literature and information technologies.
- **M02CM11**: Be able to relate chemistry with other disciplines and understand its impact on today’s society and the importance of the industrial chemical sector.

## Theoretical and Practical Contents


## Teaching Methods

The content has been classified in four different modules, which will be evaluated in separate written tests.

1. Chemical thermodynamics.
2. Solutions, phase equilibria and chemical equilibria.
3. Electrochemical equilibria, surface phenomena, transport phenomena, macromolecules and colloids.

Lectures will typically consist of an explanation about the theoretical contents by the professor. Practical classes, will
generally be employed for the students to analyse and solve practical problems presented by the professor. The students will also have the opportunity of taking quizzes in order to assess their advances on the subject. Finally, in the seminar activities, the students will have a leading role and will present a subject related to the contents of the course and previously agreed with the professor.

**TYPES OF TEACHING**

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
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**Legend:**
- M: Lecture-based
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- TA: Workshop
- TI: Industrial workshop
- GCA: Applied fieldwork groups

**Evaluation tools and percentages of final mark**

- Continuous evaluation
- End-of-course evaluation

**Evaluation methods**
- Written test, open questions 70%
- Exercises, cases or problem sets 15%
- Oral presentation of assigned tasks, Reading 15%

**ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

The student will have to participate in all the following activities in order to pass the course, with the continuous assessment system: 4 written tests, seminars, practical class work.

The first three written tests will be carried out approximately in October, January and March. The student who passes a written exam will not have to take it again, and the mark will be saved for the ordinary and extraordinary calls. Those who do not pass the first written test, will have another opportunity in January. The final test for the 2nd part, in case of not passing it in January, will take place together with the 3rd part. Finally, the fourth written test, together with the 3rd (for those who have to repeat it), will take place at the ordinary call in June. When calculating the final mark obtained in these exams, a score of at least 4.5 will be required in each part of the exam for the student to pass the subject. The final mark will have to be at least 5. This test will evaluate the specific skill [M02CM01], and will account for the 70% of the final mark.

The 30% of the final mark will be the average of the results obtained in the following activities:
1. Seminars 15%
2. Practical class work 15%

The skills assessed will be: [M02CM01], [M02CM09], [M02CM10] and [M02CM011] in Seminars; [M02CM01], [M02CM09], [M02CM10] y [M02CM011] in practical classes. This is applicable to both the ordinary and extraordinary calls.

Given the continuous assessment system, the student who does not participate in the compulsory activities will fail the course. The evaluation of the ordinary call will be "not presented" only in these cases:

- The student has carried out none of the compulsory activities.
- The student has previously required the final assessment system and has not taken the exam.
- The student has previously required the "not presented" evaluation to the professor, at least one month before the last compulsory activity is carried out.

If the final exam accounts for more than 40% , it will be enough for the student not to take that exam for being qualified as "not presented". If it accounts for less than the 40%, the students who want such a qualification will have to require it to the professor more than a month before the end of the term.

The final assessment system will have to be required before the 18th week. The final exam will consist of a written exam, a presentation englobing the activities carried out in the practical classes, and an exposition on one of the subjects studied in the seminars. The percentage of these activities on the final mark will be the same as in the continuous assessment system. In these activities the student will have to prove to master the skills [M02CM01], [M02CM09], [M02CM10] and [M02CM011].

**EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT**

The extraordinary call exam will consist of a written exam about the four parts of the subjects. Those positive results
obtained in the ordinary call will be maintained. The written exam will account for the 70% of the final mark. The student who has not carried out one of the compulsory activities will be required to do so within 15 days of the written exam.

If the final exam accounts for more than 40%, it will be enough for the student not to take that exam for being qualified as "not presented". If it accounts for less than the 40%, the students who want such a qualification will have to require it to the professor more than a month before the end of the term.

For those students who have chosen the final assessment system, the conditions will be the same as for the ordinary call final assessment system.

**MANDATORY MATERIALS**

A scientific calculator is needed for the successful development of the subject and exams.

**BIBLIOGRAPHY**

**Basic bibliography**


**Detailed bibliography**


**Journals**

Journal of Physical Chemistry
Journal of Chemical Physics
Journal of Chemical Education

**Web sites of interest**

http://riodb01.ibase.aist.go.jp/sdbs/cgi-bin/cre_index.cgi
http://webbook.nist.gov/chemistry
http://www1.lsbu.ac.uk/water/water_phase_diagram.html

**OBSERVATIONS**

The students will find helpful material in the course's virtual classroom eGela.
The main objective of the subject is to study chemical-physical systems from a microscopic point of view, in such a way that the macroscopic properties of the systems developed in the subject Physical Chemistry I can be related to the individual properties of the atomic-molecular systems that constitute the matter. For this, Quantum Chemistry is presented and applied in the study of atoms and molecules, whose properties obtained by theoretical calculations are confronted with experimental data obtained from the different spectroscopic techniques. Besides, atomic and molecular spectroscopies are deeply studied, in order to analyze the physical basics of different spectroscopy types. Using Statistical Thermodynamics, physicochemical magnitudes of macroscopic systems are determined from microscopic properties. The possibility of performing quantum mechanical calculations using computer programs and the need to have experimental data to confirm the theoretical calculations, recommend that the subject include a series of Computer Practices and Laboratory Practices.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The subject is part of the Physical Chemistry Subject, being one of the Fundamental Modules of the Degree and, as such, shares the transversal competences assigned to this module. More specifically, this course develops the skills M02CM01 (Understanding and managing the principles of Physical Chemistry and its influence on chemical processes), M02CM08 (Capacity to select different instrumental techniques, simple or combined, for the characterization of chemical substances), M02CM09 (Be able to present, orally and writing, in an understandable way, phenomena and processes related to Chemistry and related subjects), M02CM10 (Ability to search and select information in the field of Chemistry and other scientific fields, making use of bibliography and information and communication technologies) and M02CM11 (Being able to relate Chemistry with other disciplines, as well as understand its impact on today's society and the importance of the industrial chemical sector).

The coordination of this subject with the rest of the Module corresponds to the Coordination Commission of the Degree in Chemistry.

Theoretical and Practical Contents

The course is divided into theoretical and practical contents

a) Theoretical content: It is divided into two different blocks

Block 1: Introduction to Quantum Chemistry


Block 2: Molecular Spectroscopy


b) Practical content: it is divided into computer practical work and laboratory practical work

P2 Laboratory Practices (Spectroscopy practices): Practices using spectroscopic techniques: IR spectroscopy, UV/Vis absorption spectroscopy, fluorescence spectroscopy, etc.

TEACHING METHODS

The syllabus of this theoretical-experimental subject has been divided into 2 blocks (each one divided into 2 modules) of an eminently theoretical nature, and 2 practical modules.

Each theoretical block will comprise a four-month period, and will be evaluated in the following controls:

Controls Block 1:
M1.1. Quantum Chemistry: application to simple systems
M1.2. Atomic and molecular structure

Controls Block 2
M2.1. Radiation-matter interaction and rotation and vibration spectroscopies: IR and Raman
M2.2. Electron spectroscopy, resonance spectroscopy: NMR and RSE, and Statistical Thermodynamics.

The Practical Modules will be divided into Computer and Laboratory sessions. Both are mandatory and will be evaluated by means of Practice Reports.

Computer sessions related to block 1 (M1.1 and M1.2) will take place in the first four-month period.
Laboratory and computer sessions related to block 2 (M2.1 and M2.2) will take place in the second four-month period.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Types of teaching</th>
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Legend:
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Evaluation methods
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- See next part 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In order to pass the subject through continuous assessment, you must participate in each and every one of the following evaluable activities: control exams, laboratory practices, computer practices, delivery of individual work and presentation of team works.
Note Weighting

Control Exams (50% of the final mark): To pass the subject it is necessary to pass the exams corresponding to the two blocks, B1 and B2, of the subject, which will be evaluated independently, each worth 25% of the final mark. Each one of these blocks may be approved by means of two partial exams or by means of an exam for the entire syllabus of the block.

Thus, the first control of block B1, corresponding to module M1.1. described in the Methodology, will be carried out approximately in November. In case of obtaining a mark equal to or greater than 5, in the ordinary exam in January only the control of the second module (M1.2) of block B1 will be carried out, being necessary to obtain a mark equal to or greater than 5 to pass this exam and so on. approve the entire block. If you have not obtained a 5 in the control exam corresponding to module M1.1. in the ordinary exam in January a single control of the entire block will be carried out, encompassing both modules (M1.1. and M1.2.), being necessary to obtain a minimum mark of 5 to be able to pass the
entire block. In case of not obtaining a 5 in this exam, a control of the entire B1 block will be carried out again in the ordinary May-June session.

The first control of block B2 (corresponding to module M2.1. described in the Methodology), will be carried out approximately between the months of March-April, and will proceed in a similar way to block B1. In case of obtaining a mark equal to or greater than 5, in the ordinary call only the control of the second module of the block (M2.2) will be carried out, being necessary to obtain a minimum mark of 5 to pass said control. In the event of having obtained a grade lower than 5 in the control related to module M2.1., in the ordinary call, a single exam will be carried out for the entire block B2, encompassing modules M2.1 and M2.2, being necessary again a minimum note of 5 to pass the block.

The remaining 50% of the note is distributed as follows:

- Laboratory practices: 20%. It includes the evaluation of the activities related to the practices (work done, quality of the results, reports). Attendance at laboratory practices will be an essential condition to pass the subject and, on the other hand, it will imply the obligatory evaluation of the subject in the ordinary call. The competencies associated with this assessment are: M02CM01, M02CM08, M02CM09 and M02CM10.

- Classroom practices: 10%. It includes the evaluation of issues and problems raised in class and that must be delivered resolved individually by the channels and within the deadlines established for their evaluation and correction. Participation in the classroom will also be valued. The competencies associated with this assessment are: M02CM01, M02CM09 and M02CM10.

- Seminars: 10%. It includes the presentation of group work and the corresponding presentations in the classroom. The competencies associated with this assessment are: M02CM01, M02CM09 and M02CM10.

- Computer practices: 10%. Includes evaluation reports. Attendance at laboratory practices will be an essential condition to pass the subject and, on the other hand, it will imply the obligatory evaluation of the subject in the ordinary call. The competencies associated with this assessment are: M02CM01, M02CM09 and M02CM10.

Given the nature of continuous evaluation, the student who fails to carry out any of the compulsory activities during the course will appear as failed in the ordinary call, regardless of the grade obtained in the rest of the activities. The qualification of NOT PRESENTED will only be obtained in the following cases:

a) In case of not carrying out any compulsory activity (controls, exercises, exhibitions, practices)

b) In the event of having requested the evaluation by means of a single test within the term (within the first 18 school weeks by means of a signed document delivered to the professor), and not appearing for it. This criterion will be applied both in the ordinary call (May-June) and in the extraordinary call (June-July).

SINGLE EXAM

In both calls, both ordinary and extraordinary, the single test will consist of the following: an exam of the theoretical content and exercises corresponding to the entire course, a practical exam corresponding to laboratory and computer practices, and the presentation of a topic developed in the seminars, using multimedia resources for it. These three different parts will be carried out in three different consecutive days. This unique test will assess the M02CM01, M02CM08, M02CM09 and M02CM10 skills.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the case of students who carry out continuous assessment, the extraordinary call will consist of two written exams, one for each block B1 and B2. Partial positive results obtained in the ordinary call may be maintained, so that each student must recover the blocks failed in the ordinary call. In case of passing these exams, the weighting of the note will be equal to that of the Ordinary Call. In case of not taking the exam, the exam will be graded as NOT PRESENTED.

In the extraordinary call (June-July) the single test is defined the same as in the Ordinary Call.

MANDATORY MATERIALS

They will be indicated in the Teaching Guide.
BIBLIOGRAPHY

Basic bibliography

Detailed bibliography

Journals
Journal of Physical Chemistry
Journal of Chemical Physics
Journal of Chemical Education
European Journal of Physics

Web sites of interest
http://www.kimikakuantikoa.blogspot.com
http://riodb01.ibase.aist.go.jp/sdbs/cgi-bin/cre_index.cgi
http://webbook.nist.gov/chemistry
http://bcw.whfreeman.com/pchem8e
http://www.shu.ac.uk/schools/sci/chem/tutorials/
http://scidiv.bcc.ctc.edu/s/s.html
http://www.ch.ic.ac.uk/vchemlib/course/mo_theory/main.html#triple
http://cccbdb.nist.gov/

OBSERVATIONS