Universidad del País Vasco Euskal Herriko Unibertsitatea

ENGLISH FRIENDLY COURSES (EFC) 2023-2024
CAMPUS OF GIPUZKOA

Link to website: https://www.ehu.eus/en/web/kimika-fakultatea/faculty-of-chemistry-donosti
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:

FACULTY OF CHEMISTRY (215)

	COURSE	SEMESTER[1]	CREDITS	SCHEDULE[2]	LINK TO SYLLABUS
Bachelor's Degree in Chemistry					
25115	Ingeniería Química	Annual	6	M	⇨
26113	Química Orgánica I	Annual	9	M	⇨
26114	Química Orgánica II	Annual	9	M/A	⇨
26126	Química Inorgánica II	Annual	9	M/A	⇨
26127	Química Analítica I	Annual	9	M/A	⇨
26128	Química Analítica II	Annual	9	M	⇨
26131	Proyectos en química industrial	Annual	6	M	⇨
26140	Resolución de problemas analíticos en Biociencias	Annual	6	M	⇨
26133	Métodos matemáticos para la química	2nd	6	M	⇨
26139	Química y Tecnología Ambiental	2nd	6	M	⇨

[1] SEMESTER: Annual: September 2023 to May 2024
1st: September 2023 to January 2024
2nd : January 2024 to May 2024
[2] SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30

English Friendly Courses taught in BASQUE:

FACULTY OF CHEMISTRY (215)					
	COURSE	SEMESTER[3]	CREDITS	SCHEDULE[4]	LINK TO SYLLABUS
Bachelor's Degree in Chemistry					
26142	Katalisia eta Bioorganometalikoak	Annual	6	M / A	⇨
26117	Kimika Fisika I	1st	9	M	⇨
26123	Kimika Fisika II	1st	9	M	⇨
26130	Kimika Biologiko Aplikatua	1st	6	M	⇨

[3] SEMESTER: Annual: September 2023 to May 2024
1st: September 2023 to January 2024
2nd : January 2024 to May 2024

[4] SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Third year

COURSE

25115 - Chemical Engineering **Credits, ECTS:** 6

COURSE DESCRIPTION

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.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

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.
2.-Material balances: Mass transfer mechanisms. Phase equilibrium. Binary and flash distillation. Multistage rectification.
3.-Energy balances: Enthalpy and energy balances. Heat transfer by conduction and convection. Heat exchangers.
4.-Non compressible fluids flow: Viscosity and flow regime. Friction and energy loss. Fluid flow in pipes.
5.-Chemical reactors: Chemical kinetics. Ideal reactor design. Batch and continuous-flow reactors. Reactor combinations.

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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	5	15						
Horas de Actividad No Presencial del Alumno/a	60	15	15						

Legend:
M: Lecture-based
S: Seminar
GA: Applied classroom-based groups
GL: Applied laboratory-based groups
GO: Applied computer-based groups
GCL: Applied clinical-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 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).
J.M. Santamaría y cols.: "Ingeniería de los reactores". Ed. Síntesis (Madrid, 1999).
O. Levenspiel. "Ingeniería de las reacciones químicas". Ed. Reverté. 2000.
O. Levenspiel: "Flujo de Fluidos e intercambio de calor". Ed. Reverté (Barcelona, 1998).

Detailed bibliography

J.M. Coulson y J.F. Richardson: "Ingeniería Química (varios volúmenes)". Ed. Reverté.
R.B. Bird. "Fenómenos de transporte". Ed. Reverté. 1976.
W.L. McCabe, J.C. Smith. "Operaciones básicas de la Ingeniería Química". Ed. Reverté. 2007.
R. Perry. "Manual del Ingeniero Químico" 8ª Edición, 2008.

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 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Second year

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.

CONTENIDOS TEÓRICO-PRÁCTICOS

Hydrocarbons, alkanes and cycloalkanes. Alkenes and polyenes. Alkynes. Benzene and arenes. Structure, obtaining and reactivity.
Functional groups with a single carbon-heteroatom bond. Alkyl and aryl halides. Alcohols, glycols and phenols. Ethers and epoxides. Amines and nitrocompounds. Structure, obtaining and reactivity.
The carbonyl group and derivatives. Aldehydes and ketones. Structure, obtaining and reactivity.
The carboxylic group and derivatives. Carboxylic acids. Acyl halides. Ketenes. Anhydrides. Esters. Amides. Nitriles. 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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	50	20	20						
Horas de Actividad No Presencial del Alumno/a	75	30	30						

Legend:
M: Lecture-based | S: Seminar | GA: Applied classroom-based groups
GL: Applied laboratory-based groups | GO: Applied computer-based groups | GCL: Applied clinical-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 80%
- Exercises, cases or problem sets 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A) GENERAL RULE
General Regulations adopted by UPV/EHU (BOPV 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.

BIBLIOGRAFÍA

Basic bibliography

1. T. W. G. Solomons, C. B. Fryhle, S. A. Snyder, ORGANIC CHEMISTRY, 12th Edition, Ed. Wiley, 2016.
2. D. R. Klein, ORGANIC CHEMISTRY, 3th Edition, Ed. Wiley, 2016.
3. L. G. Wade, Jr., QUÍMICA ORGÁNICA, 7ª Edición, Ed. Pearson Prentice Hall, Madrid, 2004.
4. P. Y. Bruice, , QUÍMICA ORGÁNICA, 5ª Edición, Ed. Pearson Prentice Hall, México, 2008.
5. F. A. Carey, QUÍMICA ORGÁNICA, 6ª Edición, Ed. McGraw-Hill, México, 2006.
6. R. T. Morrison, R. N. Boyd, QUÍMICA ORGÁNICA, 5ª Edición, Ed. Pearson Educación, México, 1998.
7. K. P. C. Vollhardt, N.E. Schore, QUÍMICA ORGÁNICA, 5ª ed., Omega, S.A., Barcelona, 2008.
8. K. P. C. Vollhardt, N.E. Schore KIMIKA ORGANIKOA, 1ª ed., UPV/EHU, Leioa, 2008.
9. J. E. McMurry, QUÍMICA ORGÁNICA, 5ª ed., International Thomson editores S.A, México, 2001.
10. F. García, J. A. Dobado, PROBLEMAS RESUELTOS DE QUÍMICA ORGÁNICA, Paraninfo, 2007.

Detailed bibliography

1. F. A. Carey, R. J. Sundberg, ADVANCED ORGANIC CHEMISTRY, Partes A y B, 5ª Edición, Springer, 2007.
2. M. B. Smith, J. March, MARCH'S ADVANCED ORGANIC CHEMISTRY: REACTIONS, MECHANISMS AND STRUCTURE, Wiley, 2007

Journals

The Journal of Organic Chemistry: http://pubs.acs.org/journal/joceah
Organic Letters: http://pubs.acs.org/journal/orlef7
European Journal of Organic Chemistry: http://www3.interscience.wiley.com/journal/27380/home
Tetrahedron: http://www.sciencedirect.com/science/journal/00404020
Tetrahedron Letters: http://www.sciencedirect.com/science/journal/00404039

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 Chemistry Portal: http://www.organic-chemistry.org/
Organic Resources Wordwide: 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://elblogdebuhogris.blogspot.com/

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Third year

COURSE

26114 - Organic Chemistry II **Credits, ECTS:** 9

COURSE DESCRIPTION

Organic Chemistry II
Type: Compulsory.
Titulación: Degree in Chemical Sciences.
Degree: Second Cycle
Departarment: Organic Chemistry I.
Credits:9

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

- Introduction to the course:

In the first cycle of the Degree, students complete the basic course Organic Chemistry I, which is focused on the study of the basic characteristics and reactivity of the most frequent functional groups in organic compounds. In addition, the basic training is completed with the study of conjugated and aromatic systems along with the most important heterocycles.
The course Organic Chemistry II is designed to delve into two main areas: stereochemistry and organic synthesis for which the students already know the fundamental principles.
Most part of the first semester is focused on knowing in detail the structure, symmetry and stereochemistry of organic compounds. The reminder of the first and the second semester deals with modern methods in organic synthesis, through general reactions and their specific versions, and the knowledge of fundamental reaction mechanisms considering chemo- and stereoselectivity aspects. The final objective of this course is to acquire enough skills to become capable of proposing short syntheses of simple molecules.

- Previous knowledge and recommendations:

It is recommended, although not a prerequisite, to have passed the course Organic Chemistry I.

Theoretical and Practical Contents

Objectives of the course:

1. Structure, symmetry and stereochemistry.
To provide an introduction to the shape of organic molecules and the basic principles and nomenclature of stereogenic elements in organic molecules.
- Diastereoselectivity.
- Stereoselective reactions.
- Enantiomers and chirality.
- Stereoisomers and constitutional isomers.
- Absolute and relative stereochemistry.
- Determination of stereochemistry by spectroscopic methods.

2. Organic reactions. Reactivity and mechanisms.
- Acidity, basicity, and pKa.
- C-C bond formation. Formation and reactions of enols and enolates. Alkylation of enolates and enamines. Conjugated additions of enolates and enamines (Michael reaction). Aldol reaction and its variants. Asymmetric methodology with enolates and enamines.

3. C=C bond formation:
- -elimination reactions (E1, E2 and E1cB).
- Pyrolytic syn elimination.
- Fragmentation reactions.
- Alkenes fron hydrazones, 1,2-diols or alquines.
- Controlling the geometry of double bonds (Wittig reaction and its variants, Julia and Peterson olefinations)
- Olefin Metathesis.

4. Functionalization of alkenes:
- Electrophilic addition to alkenes.
- Electrophilic alkenes.
- Nucleophilic conjugate addition to alkenes

5. Oxidations:
- Oxidizing agents.
- Catalytic hydrogenation.

6. Reductions:
- Reduction of carbonyl groups (Hydride additions).
- Catalytic hydrogenation.

TEACHING METHODS

Teaching methods:

In the development of the subject, a mixed methodology based on cooperative learning and self-learning will be followed. The face-to-face activities of the subject are structured mainly on master classes with great content in theoretical aspects and the individual resolution of specific problems.

Classroom activities:

1. Theoretical classes: Approximately 45 hours.
The main concepts and theoretical contents of the subject will be introduced in the theoretical classes. With the support of the blackboard and the Power-Point presentations, the teacher will present the objectives and contents of each topic and explain the basic and fundamental aspects of the subject. The student will have, in the days prior to its start, all the material presented necessary to monitor the classes in the Virtual Campus of the UPV / UHU.

2. Practical classes: Approximately 20 hours.
Preferably, problems proposed by the teacher will be solved that will contribute in a decisive way to apply the knowledge acquired in the theoretical classes. Students must have previously worked on the problems that will be solved. For which, the proposed exercises and any other necessary material will be delivered well in advance of the seminar class.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	10	15	25					
Horas de Actividad No Presencial del Alumno/a	60	22,5	15	37,5					

Legend: M: Lecture-based | S: Seminar | GA: Applied classroom-based groups | GL: Applied laboratory-based groups | GO: Applied computer-based groups | GCL: Applied clinical-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 30%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Evaluation methods and percentage in the final mark:

Mixed evaluation:

20% Partial written exam
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

El indicado por el profesor y al menos un texto de la bibliografía básica. Material personal de laboratorio, en especial bata, gafas de seguridad, espátula y guantes de látex.

BIBLIOGRAPHY

Basic bibliography

Structure, symmetry and stereochemistry:

1. E. Juaristi, Introduction to Stereochemistry and Conformational Analisis, John Wiley, New York.
2. A. Bassindale, The Third Dimension in Organic Chemistry, Ed. John Wiley & Sons, New York, 1991.
3. E. Eliel, S. H. Wilen, Stereochemistry of Organic Compounds, Ed. John Wiley & Sons, New York, 1994.
4. D. Nasipuru, Stereochemistry of Organic Compounds: Principles and Applications, John Wiley & Sons, New York, 1991.

Organic reactions. Reactivity and mechanisms:

5. F. A. Carey, Advanced Organic Chemistry, Kluver Academic, New York, 2001.
6. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, Oxford University Press, 2012.
7. D. Klein, Química Orgánica, Ed. Panamericana, 2014

Detailed bibliography

1. ORGANIC SYNTHESIS: THE DISCONNECTION APPROACH. S. Warren, P. Hyatt, Wiley, 2008.
2. ORGANIC CHEMISTRY. J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford, 2005.
3. SÍNTESIS ORGÁNICA. RESOLUCIÓN DE PROBLEMAS POR EL MÉTODO DE DESCONEXIÓN. M. Carda, S. Rodríguez, F. González, J. Murga, E. Falomir, E. CASTILLO, Publicaciones de la Universitat Jaume I, Castellón, 1996.
4. SAFETY IN ACADEMIC CHEMISTRY LABORATORIES: VOLUME 1 y 2. ACCIDENT PREVENTION FOR FACULTY AND ADMINISTRATORS, 7ª Ed. American Chemical Society, Washington, DC, 2003

Journals

Organic Syntheses: http://www.orgsyn.org/
The Journal of Organic Chemistry: http://pubs.acs.org/journal/joceah
Organic Letters: http://pubs.acs.org/journal/orlef7
European Journal of Organic Chemistry: http://www3.interscience.wiley.com/journal/27380/home
Tetrahedron: http://www.sciencedirect.com/science/journal/00404020
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 Chemistry Portal: http://www.organic-chemistry.org/
Organic Resources Wordwide: http://www.organicworldwide.net/
Bases de datos de compuestos orgánicos: http://pubchem.ncbi.nlm.nih.gov/ , http://www.chemspider.com/

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Second year

COURSE

26117 - Physical Chemistry I **Credits, ECTS:** 9

COURSE DESCRIPTION

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 [M02CM011] 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.

CONTENIDOS TEÓRICO-PRÁCTICOS

Thermochemistry. Thermodynamic laws. Maxwell’s equations. Enthalpy, entropy, and Gibbs energy: use of thermodynamic tables. Chemical potential. Equilibrium conditions.
Real and ideal solutions. Fugacity of real gas mixtures. Partial molar magnitudes. Activity coefficients. Henry’s law.
Phase equilibria. Pure substance phase diagrams: Clapeyron and Clausius-Clapeyron equations. Multicomponent systems. Liquid-liquid diagrams, liquid-vapor diagrams: azeotropes. Solid-liquid diagrams: eutectics.
Chemical equilibria. Progress of a reaction, free energy and chemical equilibrium in real gas reactions. Equilibrium constants. Heterogeneous equilibria. Equilibria in non-ionic solutions.
Electrochemical equilibria. Ionic solutions. Mean ionic activity. Debye - Hückel limiting law. Electrochemical systems. Electrochemical potential. Electrochemical cells. Standard electrode potential. Determination of thermodynamic magnitudes. Batteries and combustion cells.
Surface phenomena. Surface tension. Capillarity. Adsorption: chemisorption and physisorption. Adsorption isotherms.
Transport phenomena. Kinetic model of gases and transport properties. Thermal conductivity. Viscosity. Diffusion. Electrical conductivity on ionic solutions.
Macromolecules and colloids. Polymers and polymerisation. Average molar mass and determination methods. Conformation and configuration. Colloids: classification and preparation. Structure and stability. Micelle formation. Double electric layer.
Chemical and electrochemical kinetics. Formal kinetics. Reaction mechanisms. Reversible, branched and consecutive reactions. Chain reactions. Explosions. Collision theory. Reactions in solution. Homogeneous, heterogeneous, and enzymatic catalysis. Electrode kinetics.

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.
4. Kinetics.

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 profesor. The students will also have the opportunity of taking quizzes in order to asses 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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	45	5	40						
Horas de Actividad No Presencial del Alumno/a	67,5	7,5	60						

Legend:
M: Lecture-based | S: Seminar | GA: Applied classroom-based groups
GL: Applied laboratory-based groups | GO: Applied computer-based groups | GCL: Applied clinical-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 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 examen 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.

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Basic bibliography

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Ira R. Levine. Physical Chemistry, 6th ed. Ed. McGraw-Hill,New York, 2009.
P. Atkins, J. de Paula. Physical Chemistry Oxford University Press, 10th ed, 2014.

Detailed bibliography

J. Bertrán, J. Núñez (coords.). Química Física, 1. eta 2. bol.. Ariel Ciencia, 2002.
J. A. Rodríguez Renuncio, J. J. Ruiz Sánchez, J. S. Urieta Navarro. Termodinámica Química. Ed. Síntesis, 1999.
S. R. Logan, Fundamentos de Cinética Química, Ed. Addison Wesley-Iberoamericana, 2000.

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.

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Third year

COURSE

26123 - Physical Chemistry II **Credits, ECTS:** 9

COURSE DESCRIPTION

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

B1.1.- Quantum Chemistry basics: application to simple systems, Wave function and Schrödinger equation. Wave-particle duality. Eigenfunctions and eigenvalues. Average values. Begining of uncertainty. Translational movement: model of a potential box and the tunnel effect. Vibrational movement: harmonic oscillator. Angular momentum and rotational motion. Exact solutions of hydrogenoid atoms.
B1.2.- Atomic and molecular structure: Approximate methods, polyelectronic atoms, Pauli exclusion principle. Antisymmetry of the wave function. Spectral terms. Molecular orbital method, electronic configurations. Molecular terms. Computational Quantum Chemistry.

Block 2: Molecular Spectroscopy

B2.1. Radiation-matter interaction: Phenomena of absorption, emission and dispersion of light. Transition moments and selection rules. Intensity of the spectral signals.
B2.2. Rotation and vibration spectroscopies: IR and Raman Pure rotation spectra in linear molecules: microwaves and rotational Raman. Vibration spectra in diatomic molecules: rotational structure. Normal modes of vibration in polyatomic molecules. IR and Raman spectra. Group vibrations.
B2.3. Electron spectroscopies: Absorption spectra in diatomic molecules: vibrational structure. Chromophores. Charge transfer complexes. Fluorescence and phosphorescence. Quantum yield and lifetime. lasers. UV and X-ray photoelectron spectra.
B2.4. Resonance spectroscopy: NMR and RSE. Interaction of a magnetic field with matter. NMR: basics. Chemical shifts and spin-spin coupling. Electron spin resonance.
B2.5. Statistical Thermodynamics Fundamentals. Maxwell-Boltzmann statistics. Molecular partition functions. Calculation of thermodynamic magnitudes. Equilibrium constant. Potential energy surfaces. Transition state theory.

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

P1. Computer Practices (Computational Chemistry): Application of computational methods in quantum mechanical calculations linked to the optimization of molecular geometries, determination of molecular parameters, thermodynamic functions and spectroscopic magnitudes.
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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	35	5	15	25	10				
Horas de Actividad No Presencial del Alumno/a	52,5	7,5	22,5	37,5	15				

Legend:
M: Lecture-based — S: Seminar — GA: Applied classroom-based groups
GL: Applied laboratory-based groups — GO: Applied computer-based groups — GCL: Applied clinical-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

- 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.

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J. Casabo i Gispert, Egitura atomikoa eta lotura kimikoa. Euskal Herriko Unibertsitatea, 2009.

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A. M. Halpern, G. C. McBane. Experimental Physical Chemistry. A laboratory textbook, 3rd edition. W.H. Freeman, 2006.
O. Mo, M. Yañez. Enlace Químico y Estructura Molecular. J. M. Bosch, 2000.

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://bcs.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

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Third year

COURSE

26126 - Inorganic Chemistry II **Credits, ECTS:** 9

COURSE DESCRIPTION

In this subject the knowledge in the area of Inorganic Chemistry is depeen through the Coordination Chemistry and the Organometallic Chemistry. Furthermore the basics of Inorganic Solics Chemistry are introduced.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

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 characterisation 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.
Coordination compounds. Structure and bonding. Classification of molecules based on their symmetry. Representations and Characters Table. Spectroscopic and magnetic properties. Stability constants. Substitution reactions: kinetic and mechanisms. Electron transfer reactions. Outer and inner sphere mechanisms. Photochemical reactions. Introduction to Bioinorganic Chemistry.
Organometallic compounds. Classification of organometallic compounds: Bonding and ligand types. Effective atomic number rule. Pi acceptor and donor ligands. Organometallic compounds with sigma metal-carbon bonds. Reactivity. Applications in catalysis. Ligand types. Nomenclature. Coordination indexes and stereochemistry. Bonding theory.
Inorganic solids: Structural characteristics. Classifications. Bonding models. Structure predictions based on the type of bonding. Crystalline state and defects. Non-stoichiometric solids. Transition elements oxides. Calcogenides, silicates, phosphates, borides, carbides and metallic nitrides.
Experimental Inorganic Chemistry laboratory. Synthesis of coordination compounds and organometallics. Preparation of inorganic solids. Characterization by spectroscopic and magnetic techniques. Thermogravimetry and X ray diffraction.

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…): 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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	45	12	3	30					
Horas de Actividad No Presencial del Alumno/a	67	30	4	34					

Legend:
M: Lecture-based
S: Seminar
GA: Applied classroom-based groups
GL: Applied laboratory-based groups
GO: Applied computer-based groups
GCL: Applied clinical-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 assistance to the laboratory is compulsory.
The mark "non presented" will be given to those students non taking the final exam.

MANDATORY MATERIALS

Labcoat. Security goggles. Laboratory gloves. Espatule.

BIBLIOGRAPHY

Basic bibliography

J. Ribas, Química de la Coordinación. Ediciones Omega, S.A., Barcelona (2000).
L. Smart y E. Moore, Solid State Chemistry: an introduction. 3ª Ed., CRC Taylor & Francis (2005).

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Journals

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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.

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Second year

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

The analytical process. Chemical analysis and basic operations of the analytic process. Reactants types. Identification and determination. Sensibility. Traceability.

Introduction to statistics. Statistics of repeated measurements. Systematic and random errors. Significant figures. Error propagation. Significance criteria and results withdrawal. Precision, accuracy and detection limit.
Sampling and pretreatment. Statistic basics of sampling. Procedures. Storage and sample protection. General conditions and sample treatment requirements. Analytes recovery. Physical pretreatments.
Analytical methods for separation. Principles of analytic separation. Interference elimination and matrix simplification. Pre-concentration methods.
Liquid-liquid extraction. Organic solvents. Equilibrium distribution and efficacy. Metallic chelants extraction.
Ionic Exchange. Ionic exchangers. Exchange equilibrium: capacity and Exchange constant. Analytic applications of ionic exchange.
Applications of ionic exchange in solution. Introduction to volumetric analysis. Acid-base volumetries. Complex formation volumetries. Redox volumetries. Precipitation volumetries. Gravimetric determinations.
Basic operations in the analytic laboratory. Volumetric analysis. Gravimetric determinations. Extraction and ionic exchange techniques.

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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	24	8	15	30	13				
Horas de Actividad No Presencial del Alumno/a	36	26	22	36	15				

Legend:
M: Lecture-based — S: Seminar — GA: Applied classroom-based groups
GL: Applied laboratory-based groups — GO: Applied computer-based groups — GCL: Applied clinical-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 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

Labcoat. Security goggles. Spatula. pH paper.

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Journals

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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 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	27	13		10				
Horas de Actividad No Presencial del Alumno/a	60	44	19		12				

Legend: M: Lecture-based · S: Seminar · GA: Applied classroom-based groups · GL: Applied laboratory-based groups · GO: Applied computer-based groups · GCL: Applied clinical-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%
- Otros 30%

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 stablished 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

Daniel C. Harris, Quantitative Chemical Analysis, 7th edition. W.H. Freeman, 2007.

D.A. Skoog, F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, 7th edition. Cengage Learning, Boston, MA, 2017.

G.D. Christian, Analytical Chemistry 6th ed. Wiley (2004).

G. Schwedt, The Essential Guide to Analytical Chemistry. Wiley (Chichester, 1997).

J.C. Miller, J.N. Miller, Statistics and Chemometrics for Analytical Chemistry, 5th edition., Pearson, England, 2005.

Detailed bibliography

K.H. Esbensen. Multivariate data analysis-in practice, 5th ed. Camo AB, 2006.

S. R. Crouch, F.J. Holler, Applications of Microsoft Excel in Analytical Chemistry. (Thomson, 2004).

Journals

Journal of Chemical Education. Ed. American Chemical Society, Washington. http://jchemed.chem.wisc.edu/
Analytica Chimica Acta. Ed. Elsevier Scientific, Amsterdam. http://www.sciencedirect.com/
Talanta. Ed. Elsevier Scientific, Amsterdam. http://www.sciencedirect.com/
Analytical Chemistry. Ed. American Chemical Society,Washington. http://pubs.acs.org/journals/ancham/index.html
Analytical and Bioanalytical Chemistry. Ed. Springer Berlin / Heidelberg. www.springer.com
The Analyst. Ed. RSC Publishing, Cambridge. http://www.rsc.org/Publishing/Journals/an/index.asp

Web sites of interest

http://www.asdlib.org
http://www.chromacademy.com/

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry

Cycle .

Degree GQUIMI20 - Bachelor's Degree in Chemistry

Year Fourth year

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 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, 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.
6. Cell transformation.
7. Vector designing.
8. Check-points for the cloning process.
9. Polymerase Chain Reaction.
10. High throughput sequencing and its applications.
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.
4. Cancer cell transmission.

5. Nervous system and neurotransmissors.
6. Immune system.
7. Cell proliferation.
8. Model organisms.
9. Horizontal gene transference.
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, …) 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 consist 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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	5		15					
Horas de Actividad No Presencial del Alumno/a	60	12		18					

Legend: M: Lecture-based; S: Seminar; GA: Applied classroom-based groups; GL: Applied laboratory-based groups; GO: Applied computer-based groups; GCL: Applied clinical-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 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 40% 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

- Molecular Biology of the Gene. Watson, Baker, Bell, Gann, Levine, Losick: Cshl Press. Pierson, Seventh Edition, 2013
- Molecular cell biology. Seventh Edition. Lodish, Berk, Matsudaira, Kaiser, Krieger, Scoctt, Zipursky, Darnell: Ed. W.H FREEMAN AND CO.2013
- Biomedical Chemistry: Applying Chemical Principles to the Understanding and Treatment of Disease. Paul F. Torrence. Wiley-Blackwell, 2000.
-Bioassay Techniques for Drug Development. Atta-ur Rahman, MI Choudhary, W Thompson. Taylor-Francis, 2005

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

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Fourth year

COURSE

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

COURSE DESCRIPTION

This subject in 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

The Chemical Project: Structure and organization. Scope of a project. Chemical process design, economics and engineering. Environmental impact. Chemical plants operation.

The Chemical Industry: Inorganic compounds. Oil refining. Organic commodities and their derivatives. Sectors in the chemical industry: Polymers, coatings, agrochemicals, fertilizers, drugs…

Chemical Process Satety: 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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	45	5	10						
Horas de Actividad No Presencial del Alumno/a	67,5	7,5	15						

Legend:
M: Lecture-based — S: Seminar — GA: Applied classroom-based groups
GL: Applied laboratory-based groups — GO: Applied computer-based groups — GCL: Applied clinical-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 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. In the case of online questionnaires, the subject being evaluated

may be released from the final exam if a score higher than 7 is achieved in them.

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

"Chemical Engineering Design", Ray Sinnott, Gavin Towler, Butterworth-Heinemann, Elsevier (2019)
"Plant Design and Economics for Chemical Engineers" Max S. Peters, Klaus D. Timmerhaus, Ronald E. West, McGraw Hill (2003)
"Survey of Industrial Chemistry" 3ª edición, Philip J. Chenier, Kluwer Academic/Plenum Publishers, New York (2002)
"Chemical Process Safety: Fundmentals with Applications" 2ª edición, Daniel A. Crowl, Joseph F. Louvar, Prentice Hall, New Jersey (2002).

Detailed bibliography

"Kent and Riegel's HANDBOOK OF INDUSTRIAL CHEMISTRY AND BIOTECHNOLOGY", 11th Ed. Edited by James A. Kent, Ph.D., Springer (2007).
"Process Industry Economics. Principles, Concepts and Applications" David Brennan, Elsevier (2020)
"Developing An Industrial Chemical Process: An Integrated Approach" Joseph Mizrahi,CRC Press (2002)
"Security Risk Assessment in the Chemical and Porcess Industry" Genserik Reniers, Nima Khakzad and Pieter Van Gelder, De Gruyter (2018)

Journals

A list will be distributed every course.

Web sites of interest

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

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Third year

COURSE

26133 - Mathematical Methods for Chemistry **Credits, ECTS:** 6

COURSE DESCRIPTION

The aim of this subject is to provide the students with the mathematical tools needed to model, formulate and solve problems of interest in the field of the Chemistry.
This subject presents an expansión of the basic mathematical concepts studied in the previous subjects "Matemáticas I" and "Matemáticas II y Estadística".

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

In addition to the Basic (CBB1-CB5) and General (G0001-G0005) Skills, the student should develop the following specific skills:

M01CM04 - Understand and know how to use basic mathematical tools and data analysis processes in a scientific environment.

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

Theoretical and Practical Contents

Integral calculus with functions of several variables. Line and surface integrals
Vector calculus. Basic conceps and application. Differential operators.
Differential equations. Solving methods and applications.

TEACHING METHODS

The student is encouraged to actively participate on both thoretical and practical lectures, by posing questions, problems and so on.

Theoretical lectures will be given with the help of powerpoints files (in spanish), which can be freely accessed by the student.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	45	15							
Horas de Actividad No Presencial del Alumno/a	67,5	22,5							

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Final exam: 100%

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Final exam: 100%

MANDATORY MATERIALS

No specific material is needed.

BIBLIOGRAPHY

Basic bibliography

Vector calculus, J.E. Marsden & A. J. Tromba
Differential equations, Ross.S.L.

Detailed bibliography

No further source is required.

Journals

As above.

Web sites of interest

In internet there are plenty of courses and pages about these topics.
Students are encouraged to find futher approaches in the web.

OBSERVATIONS

No one

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	10	10						
Horas de Actividad No Presencial del Alumno/a	60	15	15						

Legend:
M: Lecture-based — S: Seminar — GA: Applied classroom-based groups
GL: Applied laboratory-based groups — GO: Applied computer-based groups — GCL: Applied clinical-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 60%
- Oral defence 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

Xavier Domènech Antúnez "Fundamentos de la química ambiental. Volumen I" Editorial Síntesis, 2014 (Madrid)
Metcalf-Eddy: "Ingeniería de aguas residuales". McGraw-Hill, 1998 (Barcelona)
C. Orozco y cols. "Contaminación ambiental". Thompson, 2003 (Madrid).
J.H. Seinfeld y S.N. Pandis: "Atmospheric Chemistry and Physics". J. Wiley, 2006 (Nueva York).

Detailed bibliography

J.E. Figueruelo y M.N. Dávila: "QuímicaFísica del ambiente y de los procesos naturales". Ed. Reverte (Madrid, 2000).
D.L. Sparks: "Environmental Chemistry of Soils". Academic Press, 2003.
Davis, W.T. (Ed.): "Air Pollution Engineering Manual", 2nd Edition, John Wiley and Sons, 2000.

Journals

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

Web sites of interest

https://climate.nasa.gov/
https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Fourth year

COURSE

26140 - Analytical Problem Solving in Biosciences **Credits, ECTS:** 6

COURSE DESCRIPTION

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

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	27	27			6				
Horas de Actividad No Presencial del Alumno/a	40	43			7				

Legend: M: Lecture-based; S: Seminar; GA: Applied classroom-based groups; GL: Applied laboratory-based groups; GO: Applied computer-based groups; GCL: Applied clinical-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 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

D.C. Harris, Análisis Químico Cuantitativo 3ª ed. (6ª ed. Original). Editorial Reverté (Barcelona, 2007).

A. Manz, N. Pamm, C. Iossifidis, Bioanalytical Chemistry. Imperial College Press (London, 2004).

M.R. Smyth (editor), Chemical Analysis on Complex Matrices. Ellis Horwood (Chichester, 1992).

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

F.W. Fifield, P.J. Haines, Environmental Analytical Chemistry 2nd ed. Blackwell Science (2000).

K.H. Esbensen. Multivariate data analysis-in practice, 5th ed. Camo AB Oslo, 2006.

Detailed bibliography

R.G. Brereton, Applied Chemometrics for Scientists. John Wiley & sons (West Sussex, 2007).

E. W. Ciurzek, J.K. Drenen III, Pharmaceutical and Medical Applications of Near-Infrared Spectroscopy. Marcel Dekker (2002).

A. Townshend (Editor), Encyclopedia of Analytical Science. Academic Press (London, 1995).

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

Journals

Analytica Chimica Acta. Ed. Elsevier Scientific, Amsterdam. http://www.sciencedirect.com/

Talanta. Ed. Elsevier Scientific, Amsterdam. http://www.sciencedirect.com/

Analytical Chemistry. Ed. American Chemical Society,Washington. http://pubs.acs.org/journals/ancham/index.html

Analytical and Bioanalytical Chemistry. Ed. Springer Berlin / Heidelberg. www.springer.com

The Analyst. Ed. RSC Publishing, Cambridge. http://www.rsc.org/Publishing/Journals/an/index.asp

Web sites of interest

OBSERVATIONS

COURSE GUIDE 2023/24

Faculty 215 - Faculty of Chemistry **Cycle** .

Degree GQUIMI20 - Bachelor's Degree in Chemistry **Year** Fourth year

COURSE

26142 - Catalysis and Bioorganometallics **Credits, ECTS:** 6

COURSE DESCRIPTION

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 medicals will be included. The student will acquire knowledge on the importance of organometallic complexes on biological systems and on medical treatments.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

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 medicals 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

Introduction. Basic concepts. The catalytic cycle. Fundamental reactions in homogeneous catalysis.
Homogeneous hydrogenation. The activation of molecular hydrogen. Important catalysts. Olefin asymmetric hydrogenation.
Other homogeneous transformations of olefins. Oxidation. Asymmetric epoxidation. Metathesis.
Carbonylation reactions. Methanol carbonylation. Hydroformylation. Asymmetric hydroformylation.
Bioorganometallic chemistry and biomedical applications. Enzymatic catalysis. Anticancer agents. Diagnosis.

TEACHING METHODS

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

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	40	5		15					
Horas de Actividad No Presencial del Alumno/a	60	7,5		22,5					

Legend:
M: Lecture-based
S: Seminar
GA: Applied classroom-based groups
GL: Applied laboratory-based groups
GO: Applied computer-based groups
GCL: Applied clinical-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 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

D. Astruc, ORGANOMETALLIC CHEMISTRY AND CATALYSIS, Springer, 2007
G. Jaouen (Ed.), BIOORGANOMETALLICS, Wiley-VCH, 2006

Detailed bibliography

R. H. Crabtree, THE ORGANOMETALLIC CHEMISTRY OF THE TRANSITION METALS, Wiley, 2005
R. J. Errington, ABVANCED PRACTICAL INORGANIC AND METALLORGANIC CHEMISTRY, Chapman&Hall, 1997.

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.

OBSERVATIONS