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

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1 SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30.
By clicking the subject’s name, its Syllabus will appear.
26114 - ORGANIC CHEMISTRY II

TEACHING GUIDE: 2018/19
Centre: 310 - Faculty of Science and Technology
Plan: GQUIIMI30 - Bachelor’s Degree in Chemistry
ECTS Credits: 9

Cycle: Indifferente
Year: Third year

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

The main spectroscopic properties of organic compounds will be analyzed. With regard to reactivity, reactions involving carbon-carbon bond formation will be discussed with a focus on the chemistry of enols, enolates and enamines, olefination and cycloaddition reactions, and a brief introduction to heterocyclic chemistry. Practical laboratory works include synthesis planning and structure determination by spectroscopic methods. "Organic Chemistry II" improves the knowledge acquired by "Organic Chemistry I", course of the second year of the degree, and prepare the student for more in-depth optional subjects "Determination of organic structures" and "Organic synthesis".

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Specific skills:
1. Ability to improve in the knowledge of the structure, properties, preparation methods and main chemical reactions of organic compounds.
2. Ability to plan and carry out in the laboratory simple synthetic procedures and characterization of chemical compounds safely and using proper techniques, and to evaluate the data derived from experimental observations in the various fields of chemistry.
3. Ability to apply the basic principles of chemistry to industrial chemical operations and to chemical installation projects.

Transversal skills:
1. Ability to select and use several instrumental techniques for the characterization of chemical entities.
2. Ability to explain orally and in writing phenomena and processes related to chemistry and associated subjects in an understandable way.
3. Ability to search for and select information in the field of chemistry and other scientific fields using the literature sources and information technologies.
4. Ability to relate Chemistry to other disciplines, as well as to understand its positive impact on society and the importance of the chemical industrial sector.
THEORETICAL/PRACTICAL CONTENT

Chapter 1. Introduction to Structure Determination by Spectroscopic methods

1.1. The electromagnetic spectrum
1.2. IR Spectroscopy. Theoretical background. Main functional groups. Instrumentation.
1.3. UV-Vis Spectroscopy. Theoretical background. Chromophores, auxochromes. Instrumentation.
1.4. NMR Spectroscopy. Theoretical background. Chemical shift. Multiplicity. Integration. $^{13}$C-NMR.
1.6. Structure determination of simple organic compounds by combining the results from several spectroscopic techniques.

Chapter 2. Chemistry of enols and enamines

2.1. Aldol condensation.
2.2. Aldol cyclization.
2.3. Claisen condensation.
2.4. Dieckmann condensation.
2.5. Michael reaction.
2.6. Enamine formation.
2.7. Alkylation of enamines.
2.8. Acylation of enamines.

Chapter 3. C-C and C=C bonds formation

3.1. Wittig reaction
3.2. Peterson olefination.
3.3. Mannich reaction.
3.4. Reformatsky reaction.
3.5. Use of other organometallic reagents.

Chapter 4. Heterocycles

4.1. Definition and classification
4.2. Saturated heterocycles. Reactivity.
4.3. Aromatic heterocycles. Reactivity.

Chapter 5. Cycloadditions

5.1. Diels-Alder reaction
5.2. 1,3-Dipolar cycloadditions

Laboratory work sessions

Session 1. Michael reaction and aldol condensation. Structure determination.
Session 3. Acetonide of the product from the stereocontrolled reduction. Structure determination.
METHODS

In lectures the student will be given the core concepts he/she needs to assimilate. The themes will be dealt with in a selection of illustrative exercise that will be provided with sufficient advance notice for preparation as non-presence-based work. The seminars are designed to make the best use of the laboratory sessions, in which the experimental work to be carried out will be examined in advance.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
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<th>GCL</th>
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</table>


ASSESSMENT SYSTEMS

- Final assessment system

TOOLS USED & GRADING PERCENTAGES

- Extended written exam 60%
- Practical work (exercises, case studies & problems set) 30%
- Individual work 10%
ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

As described in *Methods and Types of teaching*, assessment of the subject in the ordinary call will be done based on the three sections, to which a percentage or specific weight will be assigned, and reflected in the final grade of the call. This assessment will be done with special attention to:

- Written test 60%
- Practical work (exercises, cases or problems) 30%
- Individual work 10%

Two partial exams (January and May) (60%)
Laboratory (practical work + reports) and seminars (30%)
Classroom exercises (10%)

To pass the subject, you need to get a mark of at least 5.0 out of 10 in each section (independently). Passing partial exams, or even the final exam, does not guarantee that you will pass the subject, as the assessment also depends (for the remaining 40%) on the Laboratory, Seminars and Classroom work section.

The January and May exams will give an average grade, as will the five practical exercises and all classroom work that can be assessed. To reach the average mark of the two exams (January and May) you will need to score a minimum 5.0 in each one. Students who do not reach this grade will repeat the exam in the final ordinary call.

Furthermore regarding the laboratory part, the student will be asked to make brief reports on the practical work in the laboratory. The practical work, the associated reports, the laboratory notebook and the exercises done in seminars and during the practical work will also be assessed.

As for classroom work, aspects to be considered are: attendance in class, participation in class, the gradual mastery of the competences to be acquired, and the performance by the student of illustrative exercises that will be collected and scored by the professor, as well as other done throughout the year.

The student will have the opportunity to withdraw from continuous (or combined) assessment and opt for a final assessment, regardless of whether he/she has participated (or not) in continuous assessment until then. To do this, the student must present his/her withdrawal to the professor responsible for the subject in a period that will end in week 18 of the academic year (as set in the Faculty of Science and Technology). This final assessment will consist of an overall exam covering all the aspects of the subjects, and will be taken within the official exam calendar.

Finally, students who decide to waive the opportunity to sit an assessment must indicate this in writing to the professor responsible for the subject before the end of week 26.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The exam to be taken in the extraordinary call will represent 100% of the final grade. Both theoretical and practical (related to the experimental practical work in the subject) content will be evaluated.
Students not taking the exam will waive the right to this assessment.

COMPULSORY MATERIALS

Lab coat, safety goggles and lab notebook
BIBLIOGRAPHY

Basic bibliography

8. M. Carda; S. Rodríguez; F. González; J. Murga; E. Falomir; E. CASTILLO, SÍNTESIS ORGÁNICA. RESOLUCIÓN DE PROBLEMAS POR EL MÉTODO DE DESCONEXIÓN. Publicaciones de la Universitat Jaume I, Castellón, 1996.

In-depth bibliography


Journals

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

Organic Resources Worldwide: http://www.organicworldwide.net/

REMARKS
SENSORS AND ACTUATORS

This course describes the operation and use of the most common sensors and actuators, both classic and modern, with special emphasis on the underlying principles, but without overlooking practical aspects. The general characteristics of sensors that define their performance are reviewed. Sensors are studied, mainly regarding physical magnitudes that are used for transduction: resistive, capacitive, digital, etc. Their description is accompanied with examples and their signal conditioning circuits. In the case of reversible principles, the relevant actuators are studied in conjunction with the sensors. The course is completed with a brief description of electromechanical actuators.

**COURSE COMPETENCES / LEARNING OUTCOMES**

1) An ability to manage methods of designing electronic systems for data acquisition and signal conditioning, including sensors of a different nature
2) Being able to use instrumentation laboratories in different applications, including the use of automated measurement instruments and automatic control applications.
3) An ability to design closed-loop controllers for real applications, including the use of actuators, and considering problems such as noise processing and disturbance effect.
4) An ability to understand the implementation of computer systems in real time for use in an instrumentation and control laboratory.
5) Being able to communicate knowledge, results and ideas in writing, and write and document reports on work carried out.

1) An ability to understand the principle of operation of the main types of sensors and actuators, taking into account the magnitudes used in transduction and configurations that leverage these principles to implement useful, top-performing useful devices.
2) An ability to assimilate the fundamentals of basic electronic signal conditioning circuits.
3) An ability to acquire selection criteria of the elements that make up the measuring and control systems before the requirements of an application.
4) An ability to practice in the laboratory with sensors and actuators, and the functions of these devices in the automation of industrial processes and in measuring and control systems.

Theory hours (M) will be used to present the contents of the subject, encouraging the discussion with the students around said contents.

Hours of classroom practicals (GA) are used for problem solving.
Laboratory classes (GL + GO) are used for carrying out practical and experimental work.
Seminars (S) are used for presenting and discussing topics related to the subject.
Students have an official tutoring schedule available in GAUR.

**ORDINARY EVALUATION: GUIDANCE AND WAIVER**

Students have the right to decide whether they will take part in the continuous assessment system or the final evaluation system.
In continuous evaluation, the mark will be based on:
1. Attendance, attitude and participation in class.
2. Delivery of selected problems.
3. Practicals and reports.
4. Preparation and participation in the seminars
5. Final exam on course content
To pass the course, a 50% mark will be sufficient.

For the final evaluation and the extraordinary evaluation, students must take an exam which will include questions and problems related to the course practicals (15% of the mark) and seminars (15% of the mark).

Evaluation waiver: students may waive the evaluation up to 10 days before the beginning of the exam period. Should they fail to waive but not attend the exam and the rest of the marks earned not reach the minimum pass mark, the student will fail the course.
In this course, students will become familiar with basic concepts of Linear Algebra and some of their applications. Student will also be introduced to the management of mathematical language and the most common demonstration techniques.

In Degree in Mathematics, this subject shares a module with Linear Algebra and Geometry II, which is studied in the second year of the Degree. Both subjects have as common goal the understanding of the main concepts of Linear Algebra and Affine and Euclidean Geometries and their use to solve linear problems through matrices and geometric problems on planes and spaces. Likewise, both courses intend for the student to acquire basic and horizontal training in these subjects to allow them to understand and apply such knowledge and skills in multiple interrelated directions. Also, the contents studied in both will be used in both mandatory and optional higher-level courses.

In Degree in Physics, Degree in Electronic Engineering and Double Degree in Physics and Electronic Engineering, Linear Algebra and Geometry I, Differential and Integral Calculus I, Vector and Complex Analysis and Mathematical Methods comprise the Mathematics module. The central goal of this module is the acquisition of mathematical tools to allow students to focus on the physical aspects in other modules in the respective curricula. Likewise, students will learn to appreciate mathematical abstraction and conceptual rigour.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

**COMPETENCIES**
1. Solve linear equation systems.
2. Understand the concept of vector space and the basic concepts related to vector spaces (subspaces, basis, spanning set, linear transformations).
3. Calculate the Jordan canonical form of a matrix.
4. Orthogonalization of a vector system in an euclidean space.
5. Diagonalization of a quadratic form.
6. Work with points, vectors, distances and angles in affine and euclidean spaces.
7. Use references systems, subspaces and affine transformations.
8. Solve geometric problems of the plane and the spaces.
9. Classify isometries in the plane and the space, giving its type and characteristic elements.
10. Know proofs of some classical theorems.
11. Solve mathematical problems, using basic calculus and others.
12. Understand and use mathematical language. Communicate results and mathematical ideas.

**LEARNING OUTCOMES**
By the end of this course, the student should be able to:
1. Solve linear equation systems.
2. Calculate Jordan form of a matrix.
3. Calculate an orthogonalization of a vector system in an euclidean space.
4. Diagonalize a quadratic form.
5. Work with points, vectors, distances and angles in affine and euclidean spaces.
6. Use references systems, subspaces and affine transformations.

**DESCRIPTION**

**AIMS**
The main aim of this subject is to know the basic definitions of Linear Algebra and their applications. The students will learn also how to use the mathematical language and the main methods to prove a result.

**THEORETICAL/PRACTICAL CONTENT**

**UNIT 1. VECTOR SPACES.**

**UNIT 2. LINEAR TRANSFORMATIONS.**

UNIT 3. SYSTEMS OF LINEAR EQUATIONS AND DETERMINANTS.

UNIT 4. DIAGONALIZATION OF LINEAR TRANSFORMATIONS FROM V INTO V.

UNIT 5. BILINEAR AND QUADRATIC FORMS.

UNIT 6. EUCLIDEAN SPACES.

UNIT 7. AFFINE GEOMETRY
Affine structure of $\mathbb{R}^n$. Affine subspaces. Intersection and parallelism. Affine reference system.

UNIT 8. EUCLIDEAN GEOMETRY
Euclidean affine structure of $\mathbb{R}^n$. Perpendicularity. Distances and angles. Euclidean affine geometry of the plane and the space.

UNIT 9. GEOMETRIC TRANSFORMATIONS.

UNIT 10. INTRODUCTION TO CONICS AND QUADRATICS.

METHODS
Using the lecture methodology, the theoretical sessions will be presented in the master sessions, following the basic references contained in the Bibliography and the mandatory material. These lectures will be complemented with problem-solving classes in the classroom practicals. These will be proposed to the students to solve questions in which the knowledge acquired in the theoretical classes is applied. Finally, in the seminar sessions, students will take a more active role and develop issues and examples representative of the content of the subject.

TYPES OF TEACHING

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<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
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<th>GL</th>
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<th>GCL</th>
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</table>

Legend:
- M: Lecture
- S: Seminario
- GA: Pract.Class.Work
- GL: Pract.Lab work
- GO: Pract.computer wo
- GCL: Clinical Practice
- TA: Workshop
- TI: Ind. workshop
- GCA: Field workshop

ASSESSMENT SYSTEMS
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- See Guidelines and decline to sit 100%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

A final written examination will be taken on the subject taught in class on the date set in the official examination calendar of the Faculty corresponding to the regular May-June evaluation. This exam will be on the second of the dates assigned in the May June calendar for the course. This examination will evaluate the level of acquisition of all the skills associated with the subject.

In addition, in order for students to be able to measure their progress in learning the subject, two partial exams are scheduled to take place in the official exam period in January and May-June, respectively. Both partial exams will be written. The first of the partial exams will cover the content explained in the first term of the course (weeks 1-15). The second partial exam will evaluate the acquisition of the competences associated to the content explained during the second term (weeks 16-30) and will take place on the first of the dates assigned to the course in the official May-June exam calendar. Students who pass one of the two partial exams or both partial exams will not have to take the exam on the content they have passed in the final exam of the ordinary evaluation.
EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

Final written exam: 100%

COMPULSORY MATERIALS

Classroom notes. Exercise and problem sheets.

BIBLIOGRAPHY

Basic bibliography


In-depth bibliography


Journals

Useful websites

http://ocw.ehu.es/ciencias-experimentales/introduccion-al-algebra-lineal/Course_listing
http://math.about.com/od/linearalgebra/Linear_Algebra_Help_and_Tutorials.htm

REMARKS
This course aims to delve into the basic phenomena related to the physical properties of crystalline solids. It provides a basic theoretical preparation for understanding the Physics of Condensed Matter and its many practical applications.

It presupposes a good knowledge of Quantum Physics, Statistical Physics, practical notions of computation and having successfully completed the mandatory course Solid State Physics I.

Although it is not necessary to have taken the optional Quantum Mechanics and Structural Properties of Solids, they help in understanding some concepts taught in this course.

The following competences will be especially dealt with

- Being able to organise, plan and learn autonomously the fundamental concepts of Solid State Physics, based on the independent study of bibliography and the resolution of regularly assigned exercises.

- An ability to theoretically understand physical phenomena related to the fundamental properties of solids.

- An ability to interpret and correlate experimental data with basic theoretical models.

- Being able to carry out simple computational calculations on the phenomena and models studied, developing small computer programs in the MATHEMATICA language.

- An ability to understand and critically interpret the content of simple research articles related to the subject matter of the course.

The textbook indicated in the bibliography (Ashcroft and Mermin) will be used from the first day of class and it is essential to be able to follow the course, so it is highly recommended that you have it before starting the course. Apart from that book, additional Moodle material will be distributed on each topic.

Textbook pages and additional material will be regularly assigned for study outside the classroom. At the beginning of each class, students will be able to speak up to express their doubts and comments, and the teacher will focus the class according to this, clarifying any difficult points and elaborating upon the material distributed in writing.

Examples of small programs written in MATHEMATICA will also be distributed to allow students to perform calculations and show results for various examples related to the course. Based on these programs, students will be assigned tasks
relating to their modification or the design of new ones to allow results to be obtained for other examples.

Depending on the progress of the course, some classroom practice may also be evaluated, the result of which would be included in the ordinary evaluation.

VERY IMPORTANT: It is a course in which regular attendance to class is fundamental. In any case, only students who regularly attend classes will be able to submit papers throughout the course and attend evaluated classroom practicals.

\[ P = \text{Average mark of the papers delivered through eGela and, if applicable, the written partial tests carried out during the term ("evaluated classroom practicals"). Papers not delivered within deadlines and classroom practicals which have not been undertaken will get a 0 mark.} \]

WAIVERS: Failure to attend the final exam will result in a “deferral” mark.

- Pursuant to the new UPV/EHU regulations, during the first nine weeks of the term, students can waive their class mark by notifying their teacher in writing. In that case, their mark will be solely based on the final exam, without taking into account any assignments delivered or classroom practicals evaluated. Students without a class mark may have to take additional tests during the final exam to demonstrate their competence in those aspects of the course evaluated in the class mark.
AMPLIACIÓN DE MÉTODOS NUMÉRICOS

TEACHING GUIDE: 2018/19
CENTRE: 310 - Faculty of Science and Technology
PLAN: GMATEM30 - Bachelor’s Degree in Mathematics
SUBJECT: 26677 - AMPLIACIÓN DE MÉTODOS NUMÉRICOS
YEAR: Fourth year
ECTS CREDITS: 6

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

A systematic presentation is made of some of the most important methods and techniques in Numerical Analysis related to system solving and computing of eigenvalues and eigenvectors. Practical work with computers in MATLAB is an essential requirement. Conditioning and stability seen in the course Métodos Numéricos I (2nd year) are studied in depth, as well as their application to basic algorithms for the solution of problems of Linear Algebra.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Learn some advanced techniques of numerical computation and its translation into algorithms or constructive problem-solving methods.

Understand the mathematical concepts needed for the numerical computation of eigenvalues.

Apply knowledge to solving problems, both theoretical and practical.

Use an IT tool that handles and applies some of the methods studied, and which serves as a support tool to programs.

Communicate ideas on the subjects in this module, both in writing and orally.

Know rigorous proofs of some important results on the subjects in this module.

Acquire new knowledge and techniques in an autonomous manner.

THEORETICAL CONTENT

8. ALGORITHMS FOR COMPUTING EIGENVALUES. SYMMETRIC EIGENVALUE PROBLEM: QR algorithm for symmetric matrices. Divide and conquer algorithm. Other algorithms: bisection and Jacobi.


PRACTICAL CONTENT
1. Solving with MATLAB computational problems related with the subject (linear system solving , norms, singular values, rank, QR factorization and eigenvalues).
2. Design of algorithms with MATLAB for solving least squares problems.
3. Design of algorithms for computing eigenvalues and singular values.

METHODS

The theoretical content is presented in lectures, following basic references that appear in the bibliography and compulsory course material. The lectures are complemented by practical problem-solving classes in which the problems involving the knowledge acquired in class will be discussed. These problems will be notified to students in advance. In the seminars, work will be done on representative questions and examples of the subject, and the students will make presentations on themes related to its content. These presentations will be prepared in advance in small groups. Practical computer exercises will be done to acquire skills in the subject.

Projects of a mainly theoretical nature will be proposed, to be done individually or in pairs, on the subject content. To carry out these projects, students will be helped by the professors and will be periodically assessed in interviews with them. These projects, together with the final exam, make up the greater part of assessment for the subject.

Much of the work done by the student is on an individual basis. The professors will provide guidance at all times, encouraging students to do the work enthusiastically and regularly. Students will also be encouraged to use one-to-one tutorials, where they can clarify any doubts or difficulties they may encounter.

ASSESSMENT SYSTEMS
- Continuous assessment system
- Final assessment system

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The performance of practical work, individual and group projects, and the presentation of projects, can account for up to 50% of the final grade. Therefore, students should attend the individual assessment sessions with the professors. These are programmed after each project is completed. It is possible to withdraw from these assessment meetings and the periodic handing over of individual or group work, although passing the practical computer sessions is compulsory. The mark for the computer sessions accounts for 15% of the final grade.
Under certain conditions, for students in the continuous assessment modality, the final written exam may be replaced by the individual preparation of additional theoretical-practical exercises.

Students who wish to opt for final assessment should notify this within 9 weeks of the start of the term, and will have to take a final written exam that will account for 85% of the final grade. As indicated above, the remaining 15% corresponds to the evaluation of the (compulsory) practical computer work.

A student may withdraw from the call, following the rules in effect: “Artículo 12 del ACUERDO de 15 de diciembre de 2016, del Consejo de Gobierno de la Universidad del País Vasco / Euskal Herriko Unibertsitatea, por el que se aprueba la Normativa reguladora de la Evaluación del alumnado en las titulaciones oficiales de Grado”.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

To be given a positive assessment in the extraordinary call, the student must certify that he/she has obtained a mark higher than 5 out of 10 in the compulsory practical work, and take a final written exam. Practical computer work represents 15% of the final grade. Furthermore, students who obtain a mark above 5 out of 10 in the compulsory exercises done throughout the year (either individually or in groups/pairs), their grade will be maintained if they wish. In such case, the weight of this grade will be 35%.

COMPULSORY MATERIALS

Notes on the subject and a guide to MATLAB. They are available at the virtual platform.

BIBLIOGRAPHY

Basic bibliography:


In-depth bibliography:


Journals:

SIAM Journal on Matrix Analysis and Applications
Numerical Linear Algebra
Linear Algebra and its Application

Useful websites:

http://www.comlab.ox.ac.uk/nick.trefethen/home.html
http://www.cs.berkeley.edu/~demmel/
http://www.mathworks.com/moler/
http://ocw.mit.edu/courses/mathematics/18-335j-introduction-to-numerical-methods-fall-2010/index.htm
### TEACHING GUIDE
2018/19

<table>
<thead>
<tr>
<th>Centre</th>
<th>310 - Faculty of Science and Technology</th>
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<td>Cycle</td>
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<td>Year</td>
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### SUBJECT
26678 - Codes and Cryptography | ECTS Credits: 6

### DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
This course examines two major applications of mathematics in information technologies: error-correcting codes and cryptography. This course studies the tools that are arranged so that the information can be transmitted reliably and safely.

To do this, concepts of abstract algebra, which were studied in previous courses, are applied. For example, concepts and techniques studied in Linear Algebra and Geometry I, Algebraic Structures, Commutative Algebra and Algebraic Equations are useful. Codes and Cryptography is part of a module together with Algorithm Design, which analyses their complexity.

Students acquire the basic techniques of this area to enable them to use them in other fields of mathematics and, if they wish, to undertake a deeper study of algebra through other optional subjects in their fourth year.

### COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

#### SPECIFIC COMPETENCES
- An ability to understand the idea of coding and a code to detect and correct errors
- Knowing how to use syndrome-based correction method.
- Knowing how to obtain some linear codes (Hamming codes, BCH codes, ...)
- An ability to understand the idea of Public Key Cryptography.
- An ability to understand RSA and Diffie-Hellman systems.
- An ability to understand digital signatures and certificates.

#### LEARNING OUTCOMES
- Knowing how to encode and decode messages using linear codes employing the appropriate method.
- Knowing how to calculate the minimum distance of a linear code.
- Knowing how to calculate generator and parity-check matrix
- Knowing how to encrypt and decrypt messages, using the cryptographic private key and public key systems studied.

### THEORETICAL/PRACTICAL CONTENT


### METHODS
- Lectures: The master class methodology will be used to develop the theoretical part of the subject.
- Classroom practical: Proposed problems related to the theoretical content of each topic will be solved.
- Seminar: In these sessions students take on a more active role and must demonstrate the skills acquired to date in the relevant competences. Depending on the session, different activities will be performed, such as doing individual work, solving problems, etc. Attendance is mandatory.
- Computer Practical: There will be two-hour biweekly sessions. Attendance is mandatory. In these hours, programs related to the subject matter presented in the lectures will be designed and implemented using the Mathematica symbolic calculation program.
TOOLS USED & GRADING PERCENTAGES

<table>
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<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
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Legend:  
M: Lecture  
S: Seminar  
GA: Pract.Class.Work  
GL: Pract.Lab work  
GO: Pract.computer wo  
GCL: Clinical Practice  
TA: Workshop  
TI: Ind. workshop  
GCA: Field workshop

ASSESSMENT SYSTEMS

- Final assessment system

TOOLS USED & GRADING PERCENTAGES

- See Guidelines and decline to sit 100%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The theoretical-practical competences of the subject will be evaluated through the following tests:

1. Final written exam, with theory, questions and problems on the theoretical contents of the course accounting for 80% of the final mark, to be taken on the date set in the official exam calendar.

2. Computer practical exam to be taken during week 15, for 10% of the final mark.

3. Partial written exam on the course to be taken during weeks 9-10, for 10% of the final mark.

To apply the above percentages it is necessary to have obtained 4 out of 10 on the final exam and to have performed all the computer practical assignments given in class.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

There will be a final written exam on the date set in the official exam calendar in which all the theoretical and practical competences of the course will be evaluated.

This test will consist of two parts, which must be passed independently to be able to pass the course:

1. Examination of theory, with questions and problems on the theoretical contents of the course accounting for 90% of the final mark.

2. Practical computer exam, accounting for 10% of the final mark.

Students who have passed the Computer Practical part of the ordinary call and are satisfied with their mark do not need to take the computer practical exam.

COMPULSORY MATERIALS

Lecture notes and example and exercise sheets

BIBLIOGRAPHY

Basic bibliography


In-depth bibliography

Journals

Useful websites

GARCIA, M.A., MARTINEZ, L., RAMÍREZ, T. Introducción a la Teoría de Códigos.
https://ocw.ehu.eus/course/view.php?id=446
QUIROS, A. La Teoría de Códigos: una introducción a las Matemáticas de la transmisión de información

REMARKS
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

The overall aim of the course is to encourage reflection on mathematical modelling, on the current uses and applications of mathematics and to create mathematical models. In the subject, mathematical models of physics and biology will be studied, together with applications of mathematics in the present-day information and image society. The subject will also have a practical side. Various situations will be proposed that need to be translated into mathematical language, which will then be modelled and resolved to obtain a solution. It therefore combines questions of a general nature on mathematical modelling with the study of operational models, through the construction and analysis of models. Emphasis will be placed on the fact that models are justified by their adaptation to the experimental data of the phenomenon they are describing, or due to practical validity in terms of the need that they set out to satisfy.

Particular importance will also be paid to the historical aspects of the formulation of the different mathematical models.

In the subject, mathematical models applied to problems are presented, whose solutions or approximations can be found using specially studied techniques in the subjects Numerical Methods I and II, Differential Equations, Codes and Cryptography, Extension of Numerical Methods and Mathematical Programming.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

- Acquire a vision on the capacity and power of mathematics to solve practical problems, and of its applications in a wide variety of areas.

- Develop the ability to find solutions, take decisions and propose operational methods to other sciences or engineering disciplines.

- Foster the ability to use mathematics. Mathematics are also a tool that students need to learn how to use.

- Learn about interactions between different parts of mathematics towards achieving a common objective.

THEORETICAL CONTENT

1. INTRODUCTION TO MATHEMATICAL MODELLING.
2. MATHEMATICS IN THE PRESENT-DAY SOCIETY OF INFORMATION AND IMAGES.

3. MODELS IN BIOLOGY.

4. MODELS IN PHYSICS.

5. PRACTICAL WORK.

PRACTICAL CONTENT
Practical work is done with computers, implementing and applying the algorithms studied and described in the theoretical part of the subject.

METHODS

The theoretical content will be explained in lectures, following basic references that appear in the Bibliography and material of compulsory use. Lectures are complemented with problem-solving classes (practical sessions) in which students will be asked to solve questions where the knowledge acquired in the theoretical classes will be applied. Representative questions and examples of the subject content will be worked on seminars. These will usually be notified in advance so that the students can work on them with a view to later reflection and discussion in a dedicated session. Practical work with computers aimed at acquiring skills in the subject will also be done.

Students will do individual work on theory and problems in periodic seminars with the support of the professor.

An important part of the student's work is of an individual nature. The professors will provide guidance for this work and will encourage students to do it with regularity and enthusiasm. Students are also encouraged to make use of one-to-one tutorials to clarify any doubt of difficulty they may encounters in the subjects.

ASSESSMENT SYSTEMS

- Continuous Assessment System
- Final Assessment System
- Tools and percentages for grading:
  - Written exam (%): 65
  - Practical work (exercises, cases or problems) (%): 20
  - Individual work (%): 15

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

CRITERIA FOR CONTINUOUS ASSESSMENT

Written exam: 65%

Preparation, drawing up and presentation of individual work: 20%
Handing in of exercises and active participation in the different sessions: 15%

To pass the subject, the student needs to obtain a mark of 4 out of 10 in the final written exam.

CRITERIA FOR FINAL ASSESSMENT

A student who does not wish to participate in continuous assessment may officially withdraw from it in writing to the professor responsible for his/her subject, within 15 weeks of the start of the term. As well as taking the exam, a student who chooses the final evaluation modality will have to take a complementary test during the official exam period, designed for the overall assessment of the activities carried out during the year. This test may consist of an oral presentation, a computer-based demonstration or a written description of the practical knowledge acquired in the activities carried out during the year.

WITHDRAWAL:

A student who has completed the activities during the academic year but who does not present him/herself for the ordinary call will be graded as "not presented".

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The assessment criteria will be the same as those in the ordinary call. A student who has passed these activities during the year will only have to present him/herself for the written exam in the extraordinary call. In the case of a student who has not passed the assessment of these activities or has opted for the final assessment modality must also take (in the extraordinary call) a complementary test designed to assess the evaluation of activities carried out during the year, as in the case of the ordinary call.

COMPULSORY MATERIALS

- The teachers will upload useful material in the eGela virtual classroom.
- Information obtained from Internet.
- Scientific software as Mathematica.

BIBLIOGRAPHY

Basic bibliography:


J.D. MURRAY: Mathematical Biology, Springer-Verlag, 1989


In-depth bibliography:

http://calvino.polito.it/fismat/poli/pdf/lecture_notes/BnDeDm-LNs.pdf

Useful websites:

Programa "dfield" para representacion de soluciones de EDO:

http://www.cs.unm.edu/~joel/dfield/dfield.jar

Software "ESL" para la simulacion de sistemas dinámicos:

http://www.isimsimulation.com/products/esl8/
NUMERICAL METHODS IN CHEMICAL ENGINEERING
(Chemical Engineering Degree)

TEACHING GUIDE (2018/2019)

<table>
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<th>Location:</th>
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TEACHING TYPOLOGY

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TEACHERS CONTACT DATA

Name: Ana Guadalupe Gayubo Cazorla  
e-mail: anaguadalupe.gayubo@ehu.eus
Office Location: B1.P2.1  
Phone: 94 601 5449
Office Tutorials: Mondays and Thursdays from 9:30 to 11:30 h  
Tuesdays from 17:00 to 19:00 h

Name: María Pilar González Marcos  
e-mail: mp.gonzalezmarcos@ehu.eus
Office Location: B1.P1.1  
Phone: 94 601 5412
Office Tutorials: Tuesdays, Wednesdays and Fridays from 12:00 to 14:00 h

Teachers can be contacted by e-mail to fix other tutorials by appointment, if necessary

DESCRIPTION AND CONTEXT OF THE SUBJECT

This is a compulsory 2\textsuperscript{nd} year 9 ECTS subject with the objective to provide the student with the necessary calculation tools for solving complex mathematical equations. Design, analysis, synthesis and simulation of processes and operations in the Chemical and related Industries, which require solving complex mathematical equations, are among the usual works a Graduate in Chemical Engineering is supposed to carry out. Thus, the knowledge and correct management of the calculation tools acquired by coursing this subject is fundamental for working as a Chemical Engineer.

The subject is related to many others in the Chemical Engineering Degree, in particular with Chemical Kinetics, Fluid Mechanics, Heat Transfer, and Experimental Methods in Chemical Engineering I (also in the 2\textsuperscript{nd} year), or Mass Transfer, Reactor Design, Separation Processes, and Experimental Methods in Chemical Engineering II (in the 3\textsuperscript{rd} year). Abilities acquired in Numerical Methods in Chemical Engineering are necessary to solve the most complex problems in the mentioned subjects.

Before coursing this subject, the student should dominate the basic mathematical operations in engineering: differentiation and integration, one-dimensional and
multidimensional algebra, array algebra, scalar product, vector operations, surface integrals, gradients, Taylor’s theorem, analytical solution of ordinary and second level differential equations, and algorithmic and basic programming in one language (Scilab or Matlab). Besides, the student should be able to raise mass and energy balances in simple chemical processes, particularly in the steady state.

EXPECTED LEARNING OUTCOMES

The goal of this subject is for the student to learn how to handle calculation tools for solving complex numerical problems in Chemical Engineering, which means:

- The student acquires a general knowledge of numerical methods
- The student is able to choose the most adequate method or tool for each situation
- The student is able to adapt the calculation tool in order to solve a particular numeric problem

Thus, after coursing this subject, the student should be able to:

- identify the necessary calculation tool for solving a given problem in Chemical Engineering (particularly those related to steady and unsteady state mass and energy balances).
- select the most appropriate calculation method to solve each problem type
- know the calculation sequence followed by each method, and its advantages and disadvantages
- implement the method in an algorithm by using an appropriate calculation software
- modify the algorithms so that they become adequate to solve new problems
- solve the problem by using the adequate calculation method, and to reach a solution

COMPETENCES

For the above goals to be reached, the student develops the following competences, corresponding to Module I (Basic Formation), listed in the Official Document for the Chemical Engineering Degree at the University of the Basque Country (UPV/EHU):

Specific competences:

| M01CM02: | Apply knowledge of the basic subjects to facilitate understanding of the fundamentals of Engineering in general and Chemical Engineering in particular | *** |
| M01CM03: | Identify and solve the problems of Chemical Engineering by integrating the knowledge of the basic subjects | *** |
| M01CM05: | Handle the computing and graphic design tools commonly used in Chemical Engineering at present | *** |

Cross-cutting competences:

| M01CM06: | Use information and communication technologies in the context of learning (web sites to support classroom teaching, computer office tools, e-mail, etc.) at basic level | *** |
| M01CM07: | Communicate and transmit in writing, to a basic level, acquired knowledge, results, abilities and skills, in a multidisciplinary and multilingual environment | ** |
| M01CM09: | Adapt to working groups, with critical reasoning and constructive | ** |
M01CM10: Solve problems of the basic subjects, with quality criteria, environmental concern, sustainability, ethical criteria, instilling the need for personal work and promoting peace |

Key to competence development: (****) intensely, (**) moderately, (*) slightly or not at all

THEORETICAL AND PRACTICAL CONTENTS:

Theoretical program:

Lesson 1. Introduction:
Goals, calculation tools and their utility for solving different problems in Chemical Engineering with complex mathematical models are explained. The concept of convergence (necessary for iterative calculations) is introduced, and the different errors associated to approximate solutions are defined.

Lesson 2. Numerical methods and computers:
Basic programming concepts acquired in first level “Introduction to computing” are recalled. The basic structures for creating a calculation algorithm (sequence of calculations, decision-making and repetition structures) are described and how to design and schematically represent (flux diagrams and/or pseudo-codes) calculation algorithms is shown.

Lesson 3. Software:
The basic aspects of the two software packages used along the subject for calculation and programming are described: 1) Excel spreadsheets (environment, data introduction, format, basic calculation, special functions, etc.) and 2) Scilab (environment, vectors and arrays, basic calculation, programming, functions, etc.); emphasizing the tools for correct presentation of the results both numerically and graphically.

Lesson 4. Root calculation:
The utility of root calculation methods and their fundamentals are described for the student to be able to implement them in different calculation algorithms, grouped as closed (bisection and Regula-Falsi) and open (fixed-point single iteration, Newton-Raphson and secant) methods, as well as methods for calculation of multiple roots (polynomials), with typical examples. Solver Excel tool and Scilab tools (fsolve and roots) are also used for root calculation of equations and polynomials.

Lesson 5. Equation systems:
Linear and non-linear equation systems are identified, with typical examples. Fundamentals of calculation methods to solve linear equation systems (based on array calculation, such as Gauss, LU decomposition or Gauss-Seidel methods) or non-linear equation systems (which imply previous linearization of the equation system) are presented, so that they can be implemented in algorithms self-designed by the students to solve this kind of problems. Specific Excel (minversa, mmult) and Scilab (inv(A)*B, A\B, linsolve, fsolve) array functions to solve equation systems are also presented.

Lesson 6. Differential and integral calculation:
The kind of problems requiring numeric integration or differentiation is described. Fundamentals of integration of both mathematical functions (continuous systems) and discreet data (tabulated) are presented, as well as the different methods to calculate first and second-order numerical derivatives. Algorithms implementing both methods are developed. Specific Scilab functions for integration (intg, inttrap) and differentiation (numderivative) are also presented.
Lesson 7. Ordinary differential equations (ODE):
The kind of problems which require solving one or several ordinary differential equations with known initial conditions and the fundamentals for their solution (Euler, Runge-Kutta, predictor-corrector methods) are described, and self-developed algorithms are implemented by the students. Specific Scilab functions (such as ode) to solve this kind of problems are also described and used.

Lesson 8. ODE with border constraints:
Ordinary differential equation problems with border constraints (one or more initial conditions remain unknown) are identified with typical examples. Fundamentals for implementing algorithms to solve this kind of problems are presented.

Lesson 9. Curve fitting:
Typical examples which require data fitting to mathematical equations are presented, and the fundamentals of linear fitting, multiple linear fitting and non-linear fitting are described. Specific commands and functions of Excel (linest, slope, intercept, rsq) and Scilab (reglin) are also described and used.

Lesson 10. Interpolation:
Interpolation of tabulated data with typical examples and the fundamentals of several interpolation methods (Newton, Lagrange, by sectors, reverse interpolation) are described, and the specific functions and commands of Excel (trend) and Scilab (interp1, interp2d) to interpolate are explained and used.

Lesson 11. Optimization:
The fundamentals of optimization (maximum and minimum search) methods both in one and multiple dimensions are described, including the introduction of restrictions when searching for the optimum (restricted optimization). Typical examples of the different situations are presented, as well as specific Excel (solver) and Scilab (fminsearch, optim) functions to search for the optimum value of a function.

Lesson 12. Partial differential equations (PDE):
The different types of partial differential equations (elliptical, parabolic, etc.) are described, emphasizing those with the highest applicability to typical Chemical Engineering problems. Solution using finite differences and its application to a typical example is described.

Practical program (exercises, works):
The students will be proposed, along the year, several problems related to Chemical Engineering, in two levels of difficulty:

- Simple problems, to be solved by a single numerical method (named “exercises”)
- Complex problems, where the use of more than a numerical method or the systematic solution of a single problem in different conditions is required (named “works”), which requires the use of adequate programming tools (M01CM02, M01CM03).

Complex problems and some simple problems will be solved by the students in groups (thus, cooperative learning: M01CM08, M01CM09)

The list of complex problems, associated to lessons, along the year is distributed in the following:

- Lesson 4. Work # 1. Calculation of the adiabatic temperature of a flame
- Lesson 5. Work # 2. Evolution of the concentration along a tubular reactor
- Lesson 6 and 7. Work # 3 (A, B and C). Simulation of a reactor to produce sulfuric acid
Lesson 11. Work # 3 (D and E). Optimization of a reactor to produce sulfuric acid

**METHODOLOGY**

The subject is totally practical and the students learn by solving problems and designing algorithms. The students use former knowledge to create their own materials for calculation while generating new knowledge (M01CM02). Using information from the literature, they design algorithms for different calculation methods in Scilab and Excel (M01CM05, M01CM08) and, afterwards, they use the algorithms for solving mathematical problems associated to Chemical Engineering (M01CM03).

Teaching methodology includes lectures, classroom practices and computer practices, distributed as indicated at the beginning of this guide. The hours of presence are three per week distributed in two sessions: one hour session of lecture-classroom practice, and two hours session of computer practices. The activities to be carried out at each session are:

- **Lectures**: Basics and fundamentals of calculation methods are discussed, after the students have read the proposed materials (available at eGela, the virtual classroom) at home (non-presence hours).
- **Classroom practices**: Algorithms and their implementation to solve specific problems are developed by the students guided by the teacher. The students have the statements of the problems in advance, through eGela.
- **Computer practices**: Two kind of activities are carried out by the student on a computer:
  - Learning how to use calculation tools (Excel and Scilab commands), guided by the teacher (seminar classes).
  - Use of calculation tools to develop algorithms, and solving problems with those calculation tools and algorithms, following the methods proposed in classroom practices. Here, the teacher supervises the work of the students, and helps them to solve their doubts.

Non-presence activities include: previous reading and understanding of the materials to be discussed at the lectures, previous reading and planning of the problems and algorithms to be developed and solved during classroom practices, identifying and describing numerical methods associated to the proposed exercises/works, solving the proposed exercises/works, and preparing a report of the works.

Cooperative learning favors learning by generating a positive interdependence, although each student must reach the objectives of learning. Thus, although much of the work is carried out in groups, mechanisms to assure individual enforceability are used. Assistance to presence sessions is compulsory/essential.

**Virtual classroom of the subject (eGela):**

The following contents can be found ordered at the virtual classroom:

<table>
<thead>
<tr>
<th>Block</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top</strong></td>
<td>Teaching guide</td>
</tr>
<tr>
<td></td>
<td>News forum (for communicating events or reminding of activities along the course)</td>
</tr>
<tr>
<td></td>
<td>Detailed calendars (planned daily activity) so that the student can prepare the non-presence work in advance</td>
</tr>
<tr>
<td></td>
<td>Two glossaries, for Excel and Scilab, so that the students can add and</td>
</tr>
<tr>
<td>Per lesson</td>
<td>Complementary material</td>
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<td>------------------------------------------------</td>
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<tr>
<td>Written chapter in full and summary of the lesson in slides, to be read and understood before the lecture</td>
<td>Questions and comments forum, where the students can raise their doubts on exercises/works, which could be solved by other students (cooperative work) or the teacher</td>
</tr>
<tr>
<td>Collection of problem statements</td>
<td>Link to free downloading Scilab software</td>
</tr>
<tr>
<td>Evaluable activities (exercises/works), with indications and delivery term</td>
<td>Scilab manual</td>
</tr>
</tbody>
</table>

**EVALUATION PROCEDURE**

Evaluation is **continuous**, because the students basically learn by doing.

Evaluation **tools** (and **percentages**) include:

- Exams (algorithms and problems to solve individually) **60%**
- Activities (exercises/works) **30%**
- Active participation (class discussion, glossaries, forum, tutorials, etc.) **10%**

**ORDINARY CALL: ORIENTATION AND RESIGNATION**

Taking into account that evaluation is continuous, a series of evaluable activities are proposed along the course, in order to facilitate progressive understanding and development of the learning outcomes to be reached.

- **Exams (60%, individual)**
  Four individual exams are proposed and distributed along the year. Each one will be used to determine to which extent the students have reached the learning outcomes from the beginning (and thus the last exam will include all the lessons). The specific weight of each exam is:
  - 1st exam, by the middle of the first semester: **10%**
  - 2nd exam, by the end of the first semester: **25%**
  - 3rd exam, by the middle of the second semester: **25%**
  - 4th exam, by the end of the second semester: **40%**

  The minimum qualification mark is 5/10.

  **Evaluation criteria:**
  
  - Results and approach (80%): correct identification of the problem, approach to the solution, choice of the most adequate calculation tool (the quickest and most precise for the proposed problem), minimum number of operations required, and correct solution reached.
  - Clarity of the explanations (20%): clarity and understandability of the explanations given to identify the kind of problem and the solving procedure.

  The student should show an adequate use of the calculation tools both in Excel and Scilab (each software package should comprise at least 25% of the exam).

- **Exercises and works (30%)**
- At least one exercise (simple problem) is asked to be solved by the end of each lesson (individually in lessons 1, 2 and 3, and in groups in the rest). 
   **Evaluation criteria:** approach and clarity of the solution, selection of the most appropriate method, originality and personal contribution, accuracy of the result (80%); adequacy and clarity of the explanation on how the exercise is solved (20%), compliance with delivery deadlines.
- At the end of the corresponding lesson, the works above mentioned will be distributed to be solved in group. **Evaluation criteria:** results and approach (80%, selection of the adequate numerical methods, development of specific programs and functions to solve the works, obtained results), quality of the report (20%, organization, writing, grammar, orthography, literature), compliance with delivery deadlines.

- **Active participation (10%, individual):**
  Including: participation in questions and commentaries forum, in glossaries of terms (introduction of Excel and Scilab command description), in classroom discussions and problem-solving, etc.

All activities should be delivered through the virtual classroom (eGela) of the subject, which will be also used to communicate evaluations and comments (M01CM06).

**Procedure to give up continuous evaluation:** The students can give up continuous evaluation by sending a written request to any of the teachers in charge for the subject not later than week 27 in the course (end of April). If this is the case, final evaluation will consist of a single exam (100%) of the whole matter, with a minimum qualification mark of 5/10.

**Procedure to resign the ordinary call:** While in continuous evaluation, the student can resign the ordinary call until one month before classes are over. In this case, the student must send a written resignation to any of the teachers in charge for the subject. When in final evaluation, not attending the final exam will be automatically considered a resignation.

**EXTRAORDINARY CALL: ORIENTATION**
Extraordinary evaluation will consist of an individual exam (100%), comprising the whole subject. The minimum qualification mark is 5/10.

**COMPULSORY MATERIALS**
- Excel Microsoft package

**BASIC LITERATURE**

**ADVANCED BIBLIOGRAPHY**
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

The work of an engineer is multi-faceted, although its main aim is the development of new systems to convert materials and energy into useful products. Chemical engineers design processes to obtain all kinds of chemical products: pharmaceuticals, cosmetics, foodstuffs, construction materials, fibres, paper, etc. The design of processes and products is probably the most creative activity of the chemical engineer, as it allows him/her to develop new chemical and biochemical processes, introduce changes to existing processes to improve them from an environmental and/or economic point of view, etc. This activity requires creative capacity to solve problems, applying basic chemical engineering and economic principles together with aspects related to the environment, safety and health.

The aim of the subject is to learn strategies for the basic design of products and processes based on technical and economic criteria, which will serve to analyse (at a later stage) the major production process of the chemicals industry. These strategies are those applied prior to the detailed design of equipment, an aspect related to the specific subjects of the last year of the degree course.

It is a subject practically related to all the other subjects in the degree course, especially with the first three years, as it is necessary to integrate basic concepts and procedures such as:

- Proposing and solving material and energy balances in processes
- Solving the stoichiometry of chemical reactions and calculating the conversion and selectivity of the reactive agent.
- Using the first and second principles of thermodynamics.
- Using basic concepts of fluid-vapour balance.
- Using basic concepts of separation operations.
- Using basic equipment concepts for fluid transfer: pumps, compressors.
- Using the basis of heat transfer.
- Using basic equipment concepts for heat exchange.
- Using computer-assisted numerical calculations concepts.
COMPETENCES AND LEARNING RESULTS

Learning outcomes

1. Technical and scientific information search, including the literature in a foreign language (English) for the design of a chemical process to manufacture a chemical product on an industrial scale.

2. Use safety and environmental protection criteria in the design of an industrial chemical process.

3. Draw and interpret different flow diagrams (mainly Block Flow Diagram (BFD) and Process Flow Diagram (PFD)).

4. Design a base-case of a chemical process.

5. Prepare and solve the simulation of the process.

6. Use the most suitable heuristics for each design step.

7. Select the most suitable equipment for each operation unit and calculate the most appropriate design parameters.

8. Develop process heat integration using Pinch technology and design the heat exchanger network.


10. Perform the process profitability analysis.

11. Present the design results in a technical report.

12. Carry out the process design in a team.

13. Plan activities for the design of a chemical process.

14. Analyse the processes for the production of the major chemical components in the chemicals sector, based on the above-mentioned design and operation strategies.

Students will develop the competences of the Specific Technology module, related to this subject: M03CM01, M03CM02, M03CM05, M03CM06, M03CM10 y M03CM15.

Besides, developing team work activities students will achieve the following competences: M03CM11, M03CM12, M03CM13 y M03CM14.

THEORETICAL/PRACTICAL CONTENT


17.- Construction materials, metalurgy and fertilizers.


**METHODOLOGY**

1. Design of a base-case of an industrial process. Team work.
2. Reading and synthesis of reference textbooks.
3. Questionnaires
4. Case and problema solving (simulation, heat integration, cost estimation, profitability analysis, etc.).
5. Lectures
7. Oral and written presentations.
8. Exams.

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<thead>
<tr>
<th>TIPOS DE DOCENCIA</th>
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<tbody>
<tr>
<td>Tipo de Docencia</td>
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<tr>
<td>--------------------</td>
</tr>
<tr>
<td>Horas de Docencia Presencial</td>
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<tr>
<td>Horas de Actividad No Presencial del Alumno</td>
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</tbody>
</table>

**SISTEMAS DE EVALUACIÓN**

<table>
<thead>
<tr>
<th>Herramientas y Porcentajes de Calificación</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prueba escrita a desarrollar</td>
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<tr>
<td>Prueba tipo test</td>
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<tr>
<td>Defensa oral</td>
</tr>
<tr>
<td>Realización de prácticas (ejercicios, casos o problemas)</td>
</tr>
<tr>
<td>Trabajos individuales</td>
</tr>
<tr>
<td>Trabajos en equipo (resolución de problemas, diseño de proyectos)</td>
</tr>
<tr>
<td>Exposición de trabajos, lecturas...</td>
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<tr>
<td>Portfolio</td>
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</tbody>
</table>

**ORDINARY EXAM CALL**

The evaluation system is continuous. Thus, periodically some assessments are scheduled, which are subjected to evaluation, in order to develop progressively the learning outcomes.

EXAM (55 - 80%). Individually. Two partial exams will be carried out in January and May/June. The first exam is focused on a chemical process design and the second one on manufacturing processes of the main products of the chemical industry. In both exams a minimum score of 5 is required. A second chance is given in the final exam (June) for those students who have not passed the partial exams.

INVIDIVUAL AND TEAM WORK (20-45%)
Withdrawing from the continuous assessment, the final evaluation (100%) will consist on some activities (including exams, individual and group works) that will allow the achievement of both competences and learning outcomes.

If you do not wish to participate in the continuous assessment system, you should present, by hand and in writing, your withdrawal from continuous assessment to the professor responsible for the subject. You will have 18 weeks to do this, starting from the beginning of the academic year, in accordance with the centre’s academic calendar (Article 8.3 of the Rules governing student assessment in official degree courses of the UPV/EHU).

Withdrawing from the call (continuous or overall assessment) will mean you will be graded as ‘not presented’. In the case of continuous assessment, the student may withdraw from the call in the period up to one month before the completion of the classes in the corresponding subject. This withdrawal must be presented, by hand and in writing, your withdrawal from continuous assessment to the professor responsible for the subject. If it is a case of overall (final) assessment, non-presentation at the final exam set in the official calendar (in June) will mean the automatic withdrawal from the corresponding call (Article 12 of the Rules governing student assessment in official degree courses of the UPV/EHU).

**EXTRAORDINARY EXAM CALL**

EXAM (55 – 80%)

INDIVIDUAL AND TEAM WORK (20-45%)

**COMPULSORY MATERIALS**

Software for Process Simulation PRO/II.

The information and material provided in eGela virtual platform.

**BASIC BIBLIOGRAPHY**


"Product Design and Development", 4ª ed.


"Survey of Industrial Chemistry". 3ª ed.
"An introduction to Industrial Chemistry"
"Cryogenic Systems". 2ª Ed.
"Sulfuric acid manufacture Analysis Control and Optimization"

IN-DEPTH BIBLIOGRAPHY
"Chemical Product Design".
"Chemical Engineering Design", 5ª ed.
"Plant Design and Economics for Chemical Engineers"
"Systematic Methods of Chemical Process Design"
"Encyclopedia of Chemical Processing and Desing",
Mcketta, John J. (Ed.),. Marcel Dekker, INC. New York (1977-).
"Inorganic Chemistry - An Industrial and Environmental Perspective",
"Industrial Organic Chemistry". 3ª ed.,
"Handbook of Industrial Chemistry",

WEBSITES
http://www.cheresources.com/process_design.shtml
http://www.process-design-center.com/
http://www.ingquimica.com/
Course Description and Context

Limnology is the study of inland waters, which may include lakes, streams, rivers, estuaries and wetlands. The history of Limnology goes hand in hand with that of Ecology. Modern limnologists are interested in the advancement of their science, but also in its application to the conservation and improvement of aquatic ecosystems. The Limnology program is organised by presenting the physics, chemistry and biology of water bodies, and then develops aspects of ecosystem structure and function and addresses the causes and possible solutions of environmental problems.

Course Competences/Learning Outcomes

Specific competences:
An ability to understand the physical environment in order to interpret the structure and functioning of ecosystems and to evaluate, plan, manage, conserve and restore inland populations and aquatic ecosystems.
An ability to manage the knowledge of instrumental subjects that allow us to obtain information, designing experiments and interpreting results in Limnology.

Horizontal competences:
An ability to provide services and direct, write and execute projects within the scope of one’s professional skills, as well as in dissemination to the scientific community and society.
An ability to develop the ability to analyse, synthesise, organise and plan to allow for decision-making.
An ability to acquire tools for continuous autonomous learning and the promotion of initiative, innovation, motivation for quality and sensitivity to environmental issues.
An ability to develop skills in interpersonal relationships that encourage teamwork and progress in critical thinking.

Expected results in the field of Limnology:
Managing appropriate concepts and terminology
Expressing oneself orally and in writing in a suitable manner
Managing appropriate techniques and equipment
Acquiring habits in the search and selection of scientific information
Understanding the possibilities and current world trends in research in different areas
Preparing reports on solved problems

Other expected results:
Developing meticulousness, rigour, curiosity and an attitude of seeking and analysing to contribute to the general training of a Biologist as a future professional.

Theoretical-practical content

Theoretical lecture programme

Introduction Limnology: object of study
Water as a medium
Introduction to Inland Water Chemistry
Producers and primary production
Consumers
Wetlands and other inland water bodies
Environmental problems and applied limnology

Practicals programme

Field trip: continental aquatic systems.

Methodology

Lectures
Combined Field and Laboratory practicals
Field trip
Tutorials
Evaluation tests Final exam on lectures (minimum 80% of the total mark). Papers on field and laboratory practicals. Practicals are compulsory regardless of their value.

Evaluation systems

- FINAL EVALUATION SYSTEM
  - Scoring tools and percentages:

Ordinary evaluation: Guidance and waiver:

Evaluation tests:
Ordinary evaluation:
- Final exam
- Paper on field and laboratory practicals.
Practicals are compulsory regardless of their value.
Only the person who has submitted the work will be able to take the exam. Otherwise it will be understood as a waiver of the evaluation.

Extraordinary evaluation: Guidance and waiver

Extraordinary evaluation:
- Final exam
- Anyone who wishes may re-submit the paper. Otherwise, the mark obtained in the previous evaluation will be maintained.
Only the person who has submitted the work will be able to take the exam. Otherwise it will be understood as a waiver of the evaluation.
DISEÑO DE SISTEMAS DIGITALES

COURSE DESCRIPTION AND CONTEXT
Digital Systems Design is an optional subject in 4th year of the Degree in Electronic Engineering. In particular, the subject is part of the speciality General Purpose Electronic Systems. The subject focuses on providing students with knowledge and skills to allow them to tackle an advanced project in designing a digital system in different fields of application, using programmable logic devices and the latest technologies of design with VHDL. Architectures and designs for high speeds, optimisation of resources and optimisation of consumption. In order to approach the design of digital systems it is necessary for students previously study the 3rd year subject of the Degree in Electronic Engineering, Digital Electronics subject which introduces the theoretical and practical fundamentals. In relation to the professional field, Digital Systems Design is an eminently practical course that contributes to a successful profile for students and their insertion in different sectors where the design of circuits and digital electronic systems has a wide implantation: Consumer Electronics and Professional Electronics (including Industrial, Electromedicine, Defence and Instrumentation).

COURSE COMPETENCES / LEARNING OUTCOMES
At the end of the course students are expected to have acquired the following competences:
An ability to acquire dexterity in advanced aspects of the analysis and design of circuits and current digital electronic systems.
An ability to understand and apply the most modern methods and techniques used in the planning, design and operation of circuits and complex digital electronic systems in various areas of application.
An ability to understand and manage with ease computer tools to help design digital circuits on reconfigurable devices, promoting the use of ICTs.
Being able to follow and understand the development and evolution of electronic devices and technologies, particularly in the field of digital electronics.
Being able to approach the resolution of real practical problems, individually or in groups, in the development of digital electronic systems.
An ability to communicate, both orally and in writing, knowledge, results and ideas related to analogue electronics.

METHODOLOGY
The subject is taught through lectures (20 h), practicals (10 h) and seminars (5 h). In addition to classroom practicals, the course also includes laboratory practicals (15 h) and computer practicals (10 h). In the first half of the course, theory classes are present the fundamentals of the technology of programmable devices, from the first devices to their current state. The theory classes of the second half are on the VHDL language. With regard to the theoretical part of the course, there are exercises in the design of circuits and digital systems. Periodically a class is devoted to discussing the solutions proposed by the students. Learning is complemented with the design, programming and verification of digital systems of practical interest in the laboratory using computational tools to aid design and development cards. In addition, the eGela
tool is used as a means of communicating with students and as a platform for disseminating material and teaching resources.

**ORDINARY EVALUATION: GUIDANCE AND WAIVER**

Written long-answer test
Practicals (exercises, cases or problems)
Presentation of papers, readings
Individual written exam: 60% of the course mark
Laboratory practicals examination and oral presentation: 40% of the mark.
The written exam will consist of problems to be solved and questions on theory applied to the problems. The final mark will be obtained from the weighted average of the previous marks, but it is necessary to get a minimum mark of 5 out of 10 in the individual written exam.
Molecular Pharmacology is a 4th year elective course of the Degree in Biochemistry and Molecular Biology. This course will examine the molecular basis of drug action and explore how cutting-edge biotechnology and biomedical research can advance pharmacological knowledge, increasing our understanding of how drugs work. Molecular Pharmacology is offered as an optional subject in the fourth and final course of this degree.

The content of the subject of Molecular Pharmacology includes the common general aspect of the drug effects, referred to the pharmacokinetics (processes of absorption, distribution, metabolism and excretion, ADME), as well as to the molecular aspects of the interaction of the drugs with their biological targets (pharmacodynamics). These concepts are structured in several introductory lectures (ADME), to then proceed to describe mechanisms of action of different groups of drugs with different molecular targets. In addition, contents focused on aspects such as Pharmacogenetics or the Development of New Drugs are also included.

Develop the capacity for analysis, synthesis and critical reasoning in the application of the scientific method, and for expressing using specific terminology of the area.

Demonstrate knowledge of the bases of the experimental strategies used in the research in Pharmacology, as well as the scientific literature of the area.

Relation of the molecular knowledge acquired in this and other subjects with their possible biomedical applications.

Understanding and relationship of the structural characteristics and functions of the drugs responsible for communication and cell signaling to obtain an integrated view of their relevance in Pharmacology.

CONTENT:

- INTRODUCTION TO PHARMACOLOGY
- BASIC PRINCIPLES OF BIOAVAILABILITY AND PHARMACOKINETICS (ADME)
- MOLECULAR ASPECTS OF THE INTERACTION OF DRUGS WITH THEIR BIOLOGICAL TARGETS
- DRUGS ACTING ON RECEPTORS, CHANNELS and TRANSPORTERS
- ENZYMES AS TARGETS OF THE ACTION OF DRUGS
- OTHER PHARMACOLOGICAL TARGETS / ANTI-MICROBIAL, ANTI-VIRAL and ANTI-TUMORAL CHEMOTHERAPY
- DEVELOPMENT OF NEW DRUGS

METHODS

In addition to general lectures, the subject includes three SESSIONS OF UPDATE AND DISCUSSION. Each lecturer
present a talk focused on an active research area within the field of MOLECULAR PHARMACOLOGY, going in depth in the most practical and translational aspect of the concepts introduced in the theoretical topics.

VISITS to the LABs
Students will VISITS TWO RESEARCH LABORATORIES (2.5 hours each) of the Department of Pharmacology of the Faculty of Medicine. During these visits, different routine techniques and experimental methodologies, and their applicability and relevance within molecular pharmacology research will be shown to the students.

COMPUTER SESSIONS
Two COMPUTER SESSIONS are established (2.5 hours each): one aimed at describing the tools and methods of data analysis of radioligand binding assays, and another focused on the use of specialized search tools and databases for the resolution of cases and problems based on the knowledge acquired in the theory.

INDIVIDUAL WORK
Each student must perform a critical review of a relevant topic related to Molecular Pharmacology and expose it in class. The exhibition will last approximately 10 minutes and should include not only the description of the topic, but also a critical review of pros and cons.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
<th>TI</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom hours</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>7.5</td>
<td>10</td>
<td>5</td>
<td>7.5</td>
</tr>
<tr>
<td>Hours of study outside the classroom</td>
<td>45</td>
<td>10</td>
<td>5</td>
<td>7.5</td>
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Legend:
M: Lecture
S: Seminario
GA: Pract.Class.Work
GL: Pract.Lab work
GO: Pract.computer wo
GCL: Clinical Practice
TA: Workshop
TI: Ind. workshop
GCA: Field workshop

ASSESSMENT SYSTEMS
- Continuous assessment system
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Extended written exam 70%
- Exposition of work, readings, etc. 30%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
MIXED evaluation system:
- Written exam (10 short questions) that will constitute 70% of the total score.
- Individual work, whose evaluation will represent 30% of the final score.
The students will have the right to be evaluated through the FINAL EVALUATION system, regardless of whether or not they had participated in the continuous assessment system. In this case, student must submit a written document to the teacher responsible for the subject in the first 9 weeks of fourth month period.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
In following calls only the final written exam will be taken into account (100% of the total score).

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

In-depth bibliography

**Journals**
- Nature Reviews Drug discovery
- Trends in Pharmacological Sciences- Current Opinion on Pharmacology
- Pharmacogenetics and any other subject of biochemistry and molecular biology with pharmacological applications.

**Useful websites**
- [http://www.pharmgkb.org/index.jsp](http://www.pharmgkb.org/index.jsp)

**REMARKS**
THEACHING GUIDE
2018/19

Centre: 310 - Faculty of Science and Technology
Plan: GGEOL030 - Bachelor’s Degree in Geology
Print: Indiferente
Year: Second year

SUBJECT
26790 - Stratigraphy
ECTS Credits: 6

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

The contents of this subject are designed to develop the basic stratigraphic methodology to describe and organize in space and time the rock units that compose the earth’s crust. It also considers the basic tools to establish the time succession and interpretation of the geological processes occurred throughout the history of the Earth.

It is highly recommended to have read the subject Sedimentology before enrolling this subject.

The subject Stratigraphy is very related to the subjects Sedimentology, Energetic Resources, Basin Analysis, Historical Geology and Sedimentary environments.

This subject is linked to the professional practice in research centres, oil and mining companies, environmental companies and teaching centres.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The contents of this subject are designed to develop the basic stratigraphic methodology to describe and organize in space and time the rock units that compose the earth’s crust. It also considers the basic tools to establish the time succession and interpretation of the geological processes occurred throughout the history of the Earth.

The subject aims to achieve the following specific competencies:
- Development of the basic stratigraphic methodology in order to arrange the rock units in time and space.
- Knowledge of the main sedimentary processes and environments and identification of their products.
- Understanding of the fossil record and its biostratigraphic and palaeontological implications.
- Knowledge of the sedimentary rocks, their characteristics and their geodynamic context.

And it also aims to achieve the following cross-disciplinary competencies:
- Analysis and synthesis skills.
- Ability to put knowledge to practical use.
- Autonomous and creative learning and work.
- Motivation for quality and well done work.

THEORETICAL/PRACTICAL CONTENT

Theoretical content
Lesson 2. Data collection methodology in Stratigraphy: Surficial, subsurface, aerial and laboratory/office methods.
Lesson 3. Age of rocks: relative dating and the standard chronostratigraphic chart. Absolute dating.
Lesson 6. Lithostratigraphic, biostratigraphic, chronostratigraphic, magnetostratigraphic and allostratigraphic units.
Lesson 8. Chemostratigraphy: Bases for its use. Non-isotopic (carbonate) and isotopic (oxygen, carbon and strontium isotope) chemostratigraphy.

Practical content
- Relative and radiometric dating.
- Realisation and interpretation of stratigraphic logs.
- Petrophysical (wireline) log interpretation.
- Interpretation of seismic profiles.
- Correlations. Realization and interpretation of stratigraphic and chronostratigraphic cross-sections.

Field training
TOOLS USED & GRADING PERCENTAGES

- Multidisciplinary stratigraphy. Litho-, bio-, chrono- and magnetostratigraphic units, and depositional sequences.

METHODS

The methodology of the subject is based on theory lectures, where basic theoretical contents are explained. This lectures are complemented by practical sessions and field training, where theoretical contents are applied on real case studies.

TYPES OF TEACHING

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<th>Type of teaching</th>
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Legend:

ASSESSMENT SYSTEMS

- Continuous assessment system
- Final assessment system

TOOLS USED & GRADING PERCENTAGES

- Extended written exam  70%
- Practical work (exercises, case studies & problems set)  25%
- Positive attitude and participation (questions, answers, etc.)  5%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

Assessment methodology
- Final exam: 70%
- Practical work (exercises, case studies and problem set): 12.5%
- Practical work (field reports and/or field exercises): 12.5%
- Positive attitude and participation (questions, answers, etc.): 5%

It is a condition to obtain at least 5 points out of 10 in the final exam in order to pass the subject.

Ways
The student has the right to decline the continuous assessment: the student has to present a written form to the lecturer during the first 9 weeks after beginning of the term, following the application of current regulations of the UPV/EHU (BOPV, 13th march 2017, nº 50, article 8.3).

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

In the extraordinary exam call, grading of the final exam, practical work and field training will weigh the same as in the ordinary call.

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

In-depth bibliography

Journals
Sedimentology
Sedimentary Geology
Journal of Sedimentary Research
Stratigraphy
Lethaia

Useful websites
http://www.stratigraphy.org/
http://strata.geol.sc.edu/exercises/ExercisePrintOuts.html
http://facstaff.gpc.edu/~pgore/geology/historical_lab/contents.php
http://www.bib.ub.edu/recursos-informacio/guies-tematiques/geologia/#c4820
http://strata.geol.sc.edu/
http://www.glossary.oilfield.slb.com/

REMARKS
It is highly recommended to have read the subject Sedimentology before enrolling this subject. Otherwise, the student may
have struggles to follow the subject.
CONTEXT AND DESCRIPTION

Sedimentology is the scientific study of sediment formation and its subsequent transformation into sedimentary rock. In addition, the environmental conditions under which these processes take place are studied.

In order to access the course, applicants are expected to have foundation level knowledge of Geology, Physics, Chemistry and Biology (studied the 1st year of the degree course in Geology at the University of the Basque Country). In terms of contents, Sedimentology is a cornerstone in the study of other geological specializations studied in our degree course. These include Stratigraphy (2nd year), Sedimentary petrology and Multidisciplinary camp (3rd year), and Energy resources, Sedimentary environments, and Basin analysis & historic geology (4th year). In addition, Final Projects invariably require sedimentological knowledge.

Regarding career opportunities, the exploration and exploitation of natural resources, groundworks (environmental, construction, etc.), and R&D all require professionals with a sound knowledge of Sedimentology.

LEARNING OUTCOMES AND COMPETENCES

Successful students will acquire a sound knowledge of physical, chemical and biological sedimentary processes, from their identification through to interpretation (sedimentary facies). Additionally, students will acquire an understanding of the abovementioned sedimentary processes and products in the context of terrestrial, transitional and marine environments (i.e., facies associations and sequences).

CORE COMPETENCES:

MO4.GM4.1. To have an understanding of the main sedimentary processes and environments, and to be able to identify their sedimentary products.

MO4.GM4.6. To have an understanding of sedimentary rocks, their characteristics and their geodynamic context.

MO4.GM4.8. To be able to identify the most common fossils and exogenous rocks in the field, and record the data adequately in a geologist’s notebook.

TRANSVERSAL COMPETENCES:

GO01. Skills of analysis and synthesis.
GO03. Skills of information gathering and managing.

GO04. Ability to put knowledge into practice.

COURSE DESCRIPTION

1. Basic concepts and learning objectives.

2. Erosion and the transport and accumulation of sediment.

3. Current driven bedforms and sedimentary structures: unidirectional water currents, multidirectional water currents (waves and tides), wind currents and second-order currents.

4. Erosion driven sedimentary structures and their relationship with corrasion, obstacles and objects.

5. Soft sediment deformation structures.


7. Bioconstructions, bioerosion and bioturbation.

8. Sedimentary systems: concepts and basic principles.

9. Continental systems.

10. Coastal and shallow marine systems.


METHODOLOGY

As students are starting from scratch in sedimentology, its fundamentals will be explained in class. In addition to this foundation, students will be expected to carry out individual study in order to deepen their knowledge and solve specific exercises set during the course. As a complement to theoretical study, both laboratory and field work will be carried out in order to put theory into practice.

CONTINUOUS ASSESSMENT

- Classroom exercises and laboratory assignments: 20%

- Field exercises and assignments: 20% (only the field sessions in which the student has participated will be taken into account; his/her mark for not attended sessions will be 0).
- Final examination: 60%

NOTICE:

An overall minimum score of 5 points out of 10 is required to pass. For the two first items (exercises and field work) to be considered in the continuous assessment program, a minimum of 4 points out of 10 has to be obtained in the third item (exam). The mark obtained in the first two items of the continuous assessment program will be kept throughout the academic year, including the end of course exam resit.

The exam will consist of two parts: theory and practice, each representing 50% of the final result of the exam. However, it is necessary that a minimum of 2 points (out of 5) is obtained in the theory part. The theory exam will include multiple choice tests, in which the negative value of the sum of all incorrect answers and the positive value of the only correct answer of each question will correspond to the same absolute number. The practical exam will include exercises similar to those done in the classroom and the laboratory (diagram blocks, sample analysis and measurement, interpretation of photographs) and the topics covered in field sessions.

If a student cannot participate in the activities to be carried out during the continuous assessment program (exercises, laboratory, field), he/she will have the option to be evaluated only with a final exam which will include all the parts of the subject (theory content, exercises, laboratory work and field work). In order to take advantage of this option, it has to be communicated in writing to the appropriate lecturer in the first two weeks of the academic year.
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

The aim of Basin analysis and Historical Geology is to provide a broad comprehensive view on the origin, architecture and evolution of sedimentary basins, taking into account that sediments are the main archive of the physico-chemical transformations and biological evolutionary patterns occurring during Earth's history.

The knowledge of sedimentary basins is based on a dynamic multidisciplinary approach that involves a wide range of geological disciplines (Stratigraphy, Subsurface Geology, Structural Geology, Paleontology, Mineralogy, Geochemistry). However, the sedimentary nature of most basin fills makes Sedimentary Geology the key discipline for the study of the different sedimentary processes, the succession of diagenetic phases and products, and the complex relationships that can be established at different temporal and spatial scales between tectonism and sedimentation, as a function of controlling factors such as sea level changes, sediment supply, climate and subsidence.

The knowledge on sedimentary basins is of prime interest for the exploration and management of most energy, mineral and rock natural resources. It also has direct application on environmental issues, providing solutions to emerging problems such as the safe subsurface storage of CO2 and of different radioactive and liquid wastes derived from human activity. It is important to note that the history of Earth and the main events in the evolution of life cannot be fully understood without the critical understanding provided by sedimentary basin analysis.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

GENERAL CONTENTS
- Methodology for the analysis of sedimentary basins.
- Formation mechanisms.
- Description and classification.
- Sedimentary filling.
- Historical geology.

TRANSVERSAL SKILLS
- Power of synthesis and analysis.
- Group-working ability.
- Capacity of putting knowledge in practice.

SPECIFIC SKILLS
- To know and use the fundamentals of sedimentary basin analysis.
- To know adequately other disciplines that are of key interest for the study of sedimentary basins and for the comprehension of the Earth history.
- To know the practical methods of study of sedimentary basins and their application.
- To gain a spatial-temporal ability to understand the processes and products regarding the origin and evolution of the sedimentary basins.
- To understand the sustainable exploitation of the natural resources in sedimentary basins.

THEORETICAL/PRACTICAL CONTENT

Basin analysis methodology: conceptual and empirical data on stratigraphy, sedimentary processes, cycles, events, main geotectonic contexts and depositional facies models.
Basic concepts on Earth zonation and dynamics.
Basin formation mechanisms: extension, flexure and shear of the lithosphere; mantle dynamics.
Basins at stable plate areas: cratonic basins; oceanic basins.
Basins at divergent plate areas: rifts, aulacogens, passive margins.
Basins at convergent plate areas: subduction-related basins; foreland basins.
Basins at shear areas.
The sedimentary cycle: denudation, sediment transport and input, sedimentation, organic matter.
Subsidence, diagenesis and thermal history. Diagenetic processes and products; organic matter thermal degradation.
Basin fill architecture and prediction models for fossil fuels.
Historical evolution and controlling factors of depositional sequences; origin of rocks with prospective interest.

Historical Geology, introduction; Earth origin; Archean Eon. Proterozoic Eon. Phanerozoic Eon: Palaeozoic Era; Mesozoic Era; Cenozoic Era.
METHODS
Conceptual and deductive methods. Discussion and use of examples. The student should be interested and aimed to discuss and criticize the proposed subjects, being skill in processing and implementing the information.
- Magistral classes: theoretical concepts.
- Classroom exercises.
- Use of software of interest.
- Field-trips: studied concepts application.

TYPES OF TEACHING

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<td>6</td>
<td>22.5</td>
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ASSESSMENT SYSTEMS
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Extended written exam 35%
- Multiple choice test 30%
- Practical work (exercises, case studies & problems set) 15%
- Exposition of work, readings, etc. 10%
- Landa txostenak 10%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Legal provisions. 8th article of the BOPV 2017-III-3 norm; evaluation methods.

8.2. Continuous evaluation (during and after the teaching period). Evaluation methods (exam, exercises, field-trip reports,...).

Continuous evaluation:
- exercise evaluation after handing.
- report evaluation after the last field-trip. A field-exercise per field-trip is carried out by each student.
- evaluation of an oral presentation of a key subject on historical geology.

Exam evaluation:
- Written exam on practical and theoretical subjects.

8.3. If the student decides to withdraw from the examination, the withdrawal must be requested in the first nine weeks from the beginning of the teaching period.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
9th article of the BOPV 2017-III-3 norm; extraordinary examination.

9.1. If the student cannot pass the exam in the continuous evaluation, an extraordinary written exam can be done in order to test the skills and knowledge.

9.3. Results obtained in the continuous evaluation are kept (%35) and added up to those obtained in the written exam (%65).

COMPULSORY MATERIALS
BIBLIOGRAPHY

Basic bibliography

In-depth bibliography

Journals
AAPG Bulletin
Basin Research.
Marine and Petroleum Geology
Palaeogeography, Palaeoclimatology, Palaeoecology

Useful websites
http://www.aapg.org
http://www.sepm.org
http://www.sciencedirect.com

REMARKS
SUBJECT

26707 - Organic Synthesis

ECTS Credits: 6

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

In this course, previous knowledge in the areas of Organic Chemistry, in particular those related to Chemical Synthesis, will be integrated to add, expand and deepen into the ideas, concepts and strategies that allow the preparation of complex substances. Special attention will be paid to the reactions that take place with control of stereoselectivity.

It is advisable to have previously passed the course "Organic Chemistry II".

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

LEARNING OUTCOMES OF THE ADVANCED MODULE that are worked on in this course:

1. CM07. Know how to apply the knowledge of structural analysis and organic reactivity to the synthesis of drugs and molecules of biological interest.
2. CM08. Design and plan experiments efficiently to solve real chemical problems.
3. CM09. Interpret and discuss the relevant results derived from the experimental activity and translate the conclusions in the form of scientific-technical reports and oral presentations.
4. CM11. Be able to explain both orally and in a written form, in a comprehensive manner, phenomena and processes related to Chemistry and related subjects, in Basque and / or Spanish and English.
5. CM18. Know the strategies that allow the design of synthetic processes for organic molecules, including the adequate methodology for the preparation of enantio-enriched substances.
6. G002. Manage appropriately the acquired knowledge and skills to recognize and analyze new problems and propose strategies to solve them.

THEORETICAL/PRACTICAL CONTENT


2. FUNCTIONAL GROUPS INTERCONVERSION. PROTECTIVE GROUPS. Addition of functional groups (activation). Oxidation level adjustments. Protective groups.


METHODS

Lectures. The teacher will develop the subject explaining all those aspects required to facilitate the understanding and assimilation of the didactic material available to students (textbooks and on-line supplementary material, including exercises/problems).

Classroom exercises/discussions. Their purpose is to illustrate and to exercise the basic principles of the course. The starting point will be a series of exercises proposed by the teacher, where real problems are raised in the context of the preparation of complex molecules. The possible solutions will be discussed to determine the most appropriate one. The direct and personal participation of the students will serve to evaluate their progress, and this will be complemented with several individually graded written tests distributed regularly over the course period. These tests will include the individual resolution of exercises and/or problems related to any aspect of the topics covered in the course.

Seminars. They will be used for the discussion of synthetic problems selected from the literature due to their special interest, difficulty or novelty. This will include the student presentation and discussion of the synthetic approach and actual
synthesis of the target molecules. Their performance will be taken as a partial measure of the degree of assimilation achieved throughout the course.

**TYPES OF TEACHING**

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Legend:
- M: Lecture
- S: Seminario
- GA: Pract.Class.Work
- GL: Pract.Lab work
- GO: Pract.computer wo
- GCL: Clinical Practice
- TA: Workshop
- TI: Ind. workshop
- GCA: Field workshop

**ASSESSMENT SYSTEMS**

- Continuous assessment system
- Final assessment system

**TOOLS USED & GRADING PERCENTAGES**

- Extended written exam 40%
- Practical work (exercises, case studies & problems set) 45%
- Exposition of work, readings, etc. 15%

**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

Short written tests. Resolution of exercises and problems. Weight in the final grade: 45%.

Discussion and presentation of literature examples. Items to be graded will include the participation in the discussion and the quality of the personal work carried out (previous preparation, success in the resolution of the synthetic problem, degree of understanding and answers to the questions). Weight in the final grade: 15%.

Final exam. Resolution of exercises and/or problems related to any aspect of the topics covered in the course. Weight in the final grade: 40%.

Students who wish to decline to be evaluated (No Show), should indicate this in writing at least one month before the end of the classes. Students who do not wish to participate in the Continuous Assessment System, should indicate this in writing within a period of 12 weeks from the beginning of the course semester.

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

Written exam. Resolution of exercises and/or problems related to any aspect of the topics covered in the course.

**COMPULSORY MATERIALS**

**BIBLIOGRAPHY**

**Basic bibliography**

Basic textbooks (lecture and exercises):

Additional textbooks for exercises:

**In-depth bibliography**


Journals
Chemical Communications: http://www.rsc.org/publishing/journals/CC/Article.asp?Type=CurrentIssue
Journal of Chemical Education: http://jchemed.chem.wisc.edu/
Journal of the American Chemical Society: http://pubs.acs.org/journal/jacsat
Organic and Biomolecular Chemistry: http://www.rsc.org/Publishing/Journals/OB/Index.asp
Organic Letters: http://pubs.acs.org/journal/orlfr7
Organic Syntheses: http://www.orgsyn.org/

Useful websites
http://cheminf.cmbi.ru.nl/cheminf/ira/
http://www.internetchemistry.com/chemistry/retrosynthesis.htm
Quiored: Recursos educativos en Química Orgánica: http://www.ugr.es/~quiored/
Organic Resources Worldwide: http://www.organicworldwide.net/

REMARKS
**DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT**

Any Science focused on the understanding and description of Nature needs a solid foundation on Physics. Physics studies Nature at its most fundamental level.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

In general:

- Explain and analyze the essential phenomena, concepts, principles and theories related to Biology, Geology and Biochemistry.
- Know, describe, analyze and evaluate the physical environment.
- Know and apply the physical and chemical principles of Biology, Geology and Biochemistry.

Transversal competences:

G001 - Ability to analyze and synthesize and reason critically in the application of the scientific method.
G002 - Ability to solve problems.
G005 - Learning and continuous autonomous work, promoting initiative and adaptation to new situations.
M01C18 - Process and interpret data from observations and measurements according to explanatory models.

Specific competences:

Degree in Biology:
M04C03 - Know and apply the physical and chemical principles of biology.
M04C05 - Demonstrate a basic knowledge of mathematics and statistics applied to biology.

Degree in Geology:
M01GM1.3 - Development of spatial vision and the capacity of abstraction.

Degree in Biochemistry and Molecular Biology:
M01.1 - Understand and apply the basic knowledge of physics, mathematics and chemistry to biological systems
M01.7 - Master the basic terminology of the different physical quantities, and correctly use the systems of international units and their equivalences

Degree in Biotechnology:
M01CM1.1 - Understand and apply the basic knowledge of Physics, Mathematics and Chemistry to the biological and engineering systems.

**THEORETICAL/PRACTICAL CONTENT**

1. GENERAL CONCEPTS
   Unit systems. Dimensional analysis. Laws of scale.

2. INTRODUCTION TO MECHANICS

3. FLUIDS

4. THERMODYNAMICS

5. DISSEMINATION PROCESSES
6. ELECTRICITY AND MAGNETISM
Mass spectrometer.

7. WAVES AND OPTICS

8. RADIACTIVITY

METHODS
Master lessons and practical problem-solving classes.

TYPES OF TEACHING

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ASSESSMENT SYSTEMS
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Extended written exam 100%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Both in the first partial and in the final exams, 30% of the exam is a test and the remaining 70% are problems. In case the first partial is passed, it will count 1/3 over the final mark. Failing to take the final call exam (ordinary call) is equivalent to waiving the call.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
The extraordinary call exam counts 100% of the grade. Failure to take the exam (extraordinary call) is equivalent to waiving the call.

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

In-depth bibliography
Física. (2 volúmenes) P. A. Tipler Reverte (4ª edición 2000).

Journals


Useful websites
http://www.sc.ehu.es/sbweb/fisica/
http://www.colos.org/
http://webphysics.davidson.edu/Applets/TaiwanUniv/index.html
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

Main Objectives of the Course

• That the student is comfortable with the fundamental concepts of Einstein's theory of gravitation and is able to apply these concepts for the study of both compact systems and the evolution of the universe on a large scale.
• Acquire basic knowledge in calculus and differential geometry, exact solutions of Einstein's equations, interpretation of certain solutions and temporal evolution of the universe from the first moments until today.
• Learn to calculate the geodetic trajectories, the curvature tensors in an arbitrary space-time (in particular, in spaces with a high degree of symmetry).
• Get the feeling that Einstein's gravitation is probably the most beautiful theory in modern physics.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Degree competences (all transversal):

G001. Learn to pose and solve problems correctly.
G005. Be able to organize, plan and learn autonomously.
G006. Be able to analyze, synthesize and reason critically.
G008. Be able to present ideas, problems and scientific results orally and in writing.

Competences of the Fundamental Physics module (all generic):

CM01. Be able to describe the branches of current Physics.
CM02. Be able to raise and solve basic problems of these branches.
CM03. Be able to transmit basic ideas from fundamental physics to non-specialized public.
CM04. Be able to use several textbooks per subject.
CM05. Be able to lead and participate in group work.

THEORETICAL/PRACTICAL CONTENT

Program

* Introduction. Tensor analysis elements.
* The Equivalence Principle.
* Einstein's equations of the gravitational field. The solution of Schwarzschild.
* Physical cosmology.
* Cosmological models.

METHODS

Lectures on theoretical aspects, and practical problem-solving sessions.

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ASSESSMENT SYSTEMS

- Final assessment system

TOOLS USED & GRADING PERCENTAGES

- Oral defence  20%
- Practical work (exercises, case studies & problems set)  30%
- Individual work  20%
- Exposition of work, readings, etc.  30%
Not taking the ordinary call (convocatoria ordinaria) exam equals giving up the call (renuncia a la convocatoria).

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

Bibliografía
* B. Schutz (2003) Gravity from the ground up (Cambridge University Press)

In-depth bibliography

Will be announced during the course.

Journals

Useful websites

REMARKS
SUBJECT
26655 - Astrophysics
ECTS Credits: 6

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
Introduction to Astrophysics: classification of spectra, stellar atmospheres, interior of stars, equilibrium and stellar evolution.
Galaxies: structure and evolution.
Introduction to cosmology: primitive universe, dark matter and dark energy.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
Degree competences (all transversal):
G001. Learn to pose and solve problems correctly.
G005. Be able to organize, plan and learn autonomously.
G006. Be able to analyze, synthesize and reason critically.
G008. Be able to present ideas, problems and scientific results orally and in writing.

Competences of the Fundamental Physics module (all generic):
CM01. Be able to describe the branches of current Physics.
CM02. Be able to raise and solve basic problems of these branches.
CM03. Be able to transmit basic ideas from fundamental physics to non-specialized public.
CM04. Be able to use several textbooks per subject.
CM05. Be able to lead and participate in group work.

THEORETICAL/PRACTICAL CONTENT
Programme:
1. Introduction to Astronomy: celestial sphere, celestial mechanics, continuous spectrum of light.
8. Cosmology: large-scale structure, early universe, accelerated expansion.

METHODS
Lectures on theoretical aspects and practical problem-solving classes.

TYPES OF TEACHING

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<th>Type of teaching</th>
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ASSESSMENT SYSTEMS
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Extended written exam 100%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Not taking the ordinary call (convocatoria ordinaria) exam equals giving up the call (renuncia a la convocatoria).

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Not taking the extraordinary call exam equals giving up the call.
COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography


In-depth bibliography


Journals

Useful websites

REMARKS
SUBJECT
26653 - Electrodynamics  ECTS Credits: 6

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
Relativistic Description of the Electromagnetic Field, Radiation and Quantization.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
Degree competences (all transversal):
G001. Learn to pose and solve problems correctly.
G005. Be able to organize, plan and learn autonomously.
G006. Be able to analyze, synthesize and reason critically.
G008. Be able to present ideas, problems and scientific results orally and in writing.

Competences of the Fundamental Physics module (all generic):
CM01. Be able to describe the branches of current Physics.
CM02. Be able to raise and solve basic problems of these branches.
CM03. Be able to transmit basic ideas from fundamental physics to non-specialized public.
CM04. Be able to use several textbooks per subject.
CM05. Be able to lead and participate in group work.

THEORETICAL/PRACTICAL CONTENT
Program
* Special Relativity, Particle Dynamics and Electromagnetic Field.
* Radiation of moving charges.
* Multipolar analysis of EM Radiation
* Some concepts of Quantization of EM Field

Bibliography

METHODS
Lectures and Problem solving Sessions

TYPES OF TEACHING

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<tr>
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Legend:

ASSESSMENT SYSTEMS
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Oral defence 20%
- Practical work (exercises, case studies & problems set) 30%
- Individual work 20%
- Exposition of work, readings, etc. 30%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
The type of exam is negotiated with the students
EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The extraordinary exam is similar to the ordinary one

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

J.D. Jackson, Electrodinámica Clásica, Alhambra Universidad, Madrid 1980,
J.D. Jackson, Classical Electrodynamics, John Wiley, NY 1999 (3ª edición)

In-depth bibliography

A.O. Barut, Electrodynamics and classical theory of fields and particles, Dover 1980.
F. Rohrlich, Classical Charged particles, Addison-Wesley, 1990.

Journals

American Journal of Physics
European Journal of Physics
Science
Scientific American
Investigación y Ciencia

Useful websites

REMARKS
SUBJECT
26656 - Themes of Physics

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
The contents varies changing every year according to the students’ preferences. Some popular examples of the subjects treated are Geophysics, Black Holes, Nanophysics, Graphene, History of Physics, Gravitational lenses, Origin and fate of the Universe, the concept of Time, Entanglement, etc. Subjects on the border with physics can also be discussed. Participation of the students is required, and they will have to present in a subject in the classroom to be discussed by all.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
Degree competences (all transversal):
G001. Learn to pose and solve problems correctly.
G005. Be able to organize, plan and learn autonomously.
G006. Be able to analyze, synthesize and reason critically.
G008. Be able to present ideas, problems and scientific results orally and in writing.

Competences of the Fundamental Physics module (all generic):
CM01. Be able to describe the branches of current Physics.
CM02. Be able to raise and solve basic problems of these branches.
CM03. Be able to transmit basic ideas from fundamental physics to non-specialized public.
CM04. Be able to use several textbooks per subject.
CM05. Be able to lead and participate in group work.

THEORETICAL/PRACTICAL CONTENT
The contents will change every year adapting itself to the fashionable subjects, to the interests of a majority of students, or similar circumstances.

METHODS

TYPES OF TEACHING

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Legend:
M: Lecture
S: Seminario
GA: Pract.Class.Work
GL: Pract.Lab work
GO: Pract.computer wo
GCL: Clinical Practice
TA: Workshop
TI: Ind. workshop
GCA: Field workshop

ASSESSMENT SYSTEMS
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Individual work 60%
- Exposition of work, readings, etc. 40%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
The student has the right to waive the call in writing one month before the start of the exam period.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

COMPULSORY MATERIALS
BIBLIOGRAPHY

Basic bibliography
   Any contemporary book on Physics, together with the Journals:
      Scientific American
      Physics World

In-depth bibliography

Journals

Useful websites

REMARKS
**SUBJECT**  
26652 - Quantum Mechanics

**DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT**

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

**Degree competences (all transversal):**
- G001. Learn to pose and solve problems correctly.
- G005. Be able to organize, plan and learn autonomously.
- G006. Be able to analyze, synthesize and reason critically.
- G008. Be able to present ideas, problems and scientific results orally and in writing.

**Competences of the Solid State Physics module:**
- CM01. Acquire the necessary knowledge to reach a global understanding of the basic theoretical principles of the Physics of Condensed Matter.
- CM02. Correctly propose and solve problems involving the main concepts of Solid State Physics in order to acquire the basic knowledge of this branch of Physics.
- CM03. To document and pose in an organized manner subjects related to the Physics of Condensed Matter to strengthen or expand knowledge and to discern between the important and the accessory.
- CM04. Orally expose problems and questions about Condensed Matter Physics to learn to develop skills in scientific oral communication.

**THEORETICAL/PRACTICAL CONTENT**

* Pure states and mixtures: density matrix. Images of Schrödinger, Heisenberg and interaction.
  * Symmetry: angular momentum, tensor operators and Wigner-Eckart theorem. Discrete symmetries.
  * Approximation methods: WKBJ. Time-dependent perturbations: Fermi-Dirac's golden rule. Electromagnetic interaction

**METHODS**
Master lessons and practical problem-solving classes.

**TYPES OF TEACHING**

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- GCL: Clinical Practice
- TA: Workshop
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**ASSESSMENT SYSTEMS**
- Final assessment system

**TOOLS USED & GRADING PERCENTAGES**
- Extended written exam 70%
- Practical work (exercises, case studies & problems set) 30%

**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

The resolution and written delivery of at least three sets of proposed problems that constitute 30 percent of the final grade is mandatory.

Not taking the ordinary call (convocatoria ordinaria) exam equals giving up the call (renuncia a la convocatoria)

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

Not taking the extraordinary call (convocatoria extraordinaria) exam equals giving up the call (renuncia a la convocatoria).

**COMPULSORY MATERIALS**
<table>
<thead>
<tr>
<th>BIBLIOGRAPHY</th>
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<tr>
<td><strong>Basic bibliography</strong></td>
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<td>Bibliografía</td>
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<td><strong>In-depth bibliography</strong></td>
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<tr>
<td>Journals</td>
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<td>Useful websites</td>
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**REMARKS**
SUBJECT
26659 - Nuclear & Particle Physics

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
Introduction to elementary particles and interactions and nuclear physics.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
Degree competences (all transversal):
G001. Learn to pose and solve problems correctly.
G005. Be able to organize, plan and learn autonomously.
G006. Be able to analyze, synthesize and reason critically.
G008. Be able to present ideas, problems and scientific results orally and in writing.

Competences of the Solid State Physics module:
CM01. Acquire the necessary knowledge to reach a global understanding of the basic theoretical principles of the Physics of Condensed Matter.
CM02. Correctly propose and solve problems involving the main concepts of Solid State Physics in order to acquire the basic knowledge of this branch of Physics.
CM03. To document and pose in an organized manner subjects related to the Physics of Condensed Matter to strengthen or expand knowledge and to discern between the important and the accessory.
CM04. Orally expose problems and questions about Condensed Matter Physics to learn to develop skills in scientific oral communication.

THEORETICAL/PRACTICAL CONTENT
Program:
**Introduction: fundamental interactions and particles. Symmetries and conservation laws.**
**Radioactive decay. Alpha, beta, gamma. Radioactivity.**
**Complements (the lecturer will choose each year; the first choice veers to more fundamental aspects, and must be balanced with topics on particle physics, while the second choice is more applied, and only selected topics will be presented)**
*** Applications:
**** Detection: ionization, regimes; scintillation; time of flight; Cherenkov; calorimetry.
**** Accelerators.
**Quantum electrodynamics. Basic process.
**CPT invariance. Discrete symmetries violation.
**Weak force. W^±, Z^0, neutrinos, beta decay, Higgs.
**Strong force: mesons; baryons and colour. Quarks and gluons, QCD.
**Beyond the standard model.

METHODS
Lectures on theoretical aspects, and example sessions.

TYPES OF TEACHING

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ASSESSMENT SYSTEMS

- Final assessment system

TOOLS USED & GRADING PERCENTAGES

- Extended written exam 100%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

Not taking the ordinary call (convocatoria ordinaria) exam equals giving up the call (renuncia a la convocatoria)

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

Not taking the extraordinary call exam equals giving up the call.

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography
- W.N. COTTINGHAM, D.A. GREENWOOD: An Introduction to Nuclear Physics.

In-depth bibliography

Journals

Useful websites

REMARKS
PETROLEUM AND PETROCHEMISTRY

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

“Petroleum and Petrochemistry” is one of the optional subjects taught in the fourth term of the 4th year of the Degree in Chemical Engineering. It is part of the module called Intensification. In this subject the basis of oil refining is studied and an introduction is made to the different processes that make up the petrochemical sector.

Given its nature of intensification in the knowledge and application of raw materials in chemical engineering, it helps the training of chemical engineers through the development of processes to convert crude oil and oil fractions (including waste product recovery) into useful products for the consumer society. In this respect, scientific and technical knowledge about the chemical processes used in the petroleum and petrochemical industry will help chemical engineers to optimise production processes and introduce improvements into the different aspects of the process, with the aim of obtaining more efficient fuels and petrochemical products that are sustainable and more environmentally-friendly.

The work done in this subject will enable students to analyse the origin and stages of formation of petroleum and characterise the physical and chemical properties of its fractions. At the same time, the different processes of chemical transformation of petroleum and the raw materials used in the petrochemical industry (natural gas, olefins, etc.) will be studied from a scientific and technical point of view to obtain a range of useful products, from fuels and lubricating oils (in the case of a refinery) to polymers and many other derived products (in the case of the petrochemicals sector).

To take “Petroleum and Petrochemistry” without too much difficulty, the student should have a basic mastery of material and energy balances. Basic knowledge of equipment design for fluid transport and heat exchange is also necessary, and also of reaction equipment and separation operations (covered in other subjects of the degree course).

COMPETENCES AND LEARNING RESULTS

The following competences will be worked in this subject:

- Master and evaluate the technological and socioeconomic state of the chemical industry in general, and particularly in the local environment (G010).

- Apply the knowledge acquired to the development of innovative technologies and processes in strategic sectors of the chemicals sector (M04CM01).
- Use sources of data and databased related to the specific content studied in the Intensification module, plus office tools to support oral presentations (M04CM04).

- Efficiently communicate, in writing and orally, the knowledge, results and skills acquired, in a multidisciplinary and multilingual setting (M04CM05).

The following learning outcomes will be achieved:

1. Look for technical and scientific information, including the literature in English, for the analysis and justification of refining and petrochemical processes.

2. Apply criteria of safety and environmental protection in the scientific analysis of petroleum-based products.

3. Incorporate, using block diagrams, the different parts of a refinery in a general layout.

4. Handle tools to characterise petroleum fractions.

5. Create flow diagrams of the different units in a refinery.

6. Analyse the processes for the production of petroleum-derived products and natural gas-based products, based on design and operation strategies.

THEORETICAL/PRACTICAL CONTENT

SECTION I.-PETROLEUM REFINING


7.- INTEGRATION OF UNITS IN THE REFINERY. Types of refinery: “hydroskimming”, médium conversión, high conversión, mixed.


SECTION II.- PETROCHEMICAL INDUSTRY


FIELD WORK

Students will make a guided visit to the Petronor refinery in Muskiz, focusing on the laboratories for the analysis and characterisation of crude oil and its fractions. They will also have the opportunity to visit the different units of the refinery. This visit is subjected to the rules of the refinery.

METHODOLOGY

1. Lectures, combined with other cooperative learning techniques and active methodologies: Flipped Classroom, gamification, jigsaw, etc.

2. Reading and synthesis of text books.

3. Problem solving and practical activities (crude oil characterization)

4. Oral and written work presentations.

5. Questionnaires.


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<th>TIPOS DE DOCENCIA</th>
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<td>Prueba tipo test</td>
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<td>Defensa oral</td>
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<td>Realización de prácticas (ejercicios, casos o problemas)</td>
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<td>Trabajos individuales</td>
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<td>Trabajos en equipo (resolución de problemas, diseño de proyectos)</td>
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<td>Exposición de trabajos, lecturas...</td>
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ORDINARY EXAM CALL

CONTINUOUS ASSESSMENT:

- Written exam: 40% (minimum 5 of 10 )
- Case and problem solving: 20%
- Group Works (including oral presentation): 40%
FINAL ASSESSMENT:

Withdrawing from the continuous assessment, the final evaluation (100%) will consist on some activities (including exams) that will allow the achievement of both competences and learning outcomes.

If you do not wish to participate in the continuous assessment system, you should present, by hand and in writing, your withdrawal from continuous assessment to the professor responsible for the subject. You will have 9 weeks to do this, starting from the beginning of the academic year, in accordance with the centre’s academic calendar (Article 8.3 of the Rules governing student assessment in official degree courses of the UPV/EHU).

Withdrawing from the call (continuous or overall assessment) will mean you will be graded as ‘not presented’. In the case of continuous assessment, the student may withdraw from the call in the period up to one month before the completion of the classes in the corresponding subject. This withdrawal must be presented, by hand and in writing, your withdrawal from continuous assessment to the professor responsible for the subject. If it is a case of overall (final) assessment, non-presentation at the final exam set in the official calendar (in January) will mean the automatic withdrawal from the corresponding call (Article 12 of the Rules governing student assessment in official degree courses of the UPV/EHU).

EXTRAORDINARY EXAM CALL

Only the final assessment will be possible:

Written exam: 100%

COMPULSORY MATERIALS

The information and material provided in eGela virtual platform.

BASIC BIBLIOGRAPHY (Petroleum)


Ramos Carpio, M. A.; “Refino de petróleo, gas natural y petroquímica”; Ed. Fundación Fomento Innovación Industrial, Madrid (1997)


BASIC BIBLIOGRAPHY (Petrochemistry)


**IN-DEPTH BIBLIOGRAPHY**


**MAGAZINES**

Hydrocarbon Processing

Fuel

Fuel Processing Technology

Energy & Fuels

Journal of Petroleum Science and Engineering

Petroleum Science

Chemistry and Technology of Fuels and Oils

International Journal of Oil, Gas and Coal Technology

**WEBSITES**

REPSOL: http://www.repsol.com

BP OIL: http://www.bp.com

Honeywell UOP: http://www.uop.com

Instituto Francés del Petróleo: http://www.ifpenergiesnouvelles.fr/

Total: https://www.total.com/en/spain
Degree in Chemical Engineering
Faculty of Science and Technology 2018/2019

APPLIED THERMODYNAMICS

<table>
<thead>
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<th>DETAILS OF THE SUBJECT</th>
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The subject Applied Thermodynamics is a compulsory subject of the first semester of the 2nd year of the Degree in Chemical Engineering. The student requires certain basic knowledge of Physics, Chemistry and Mathematics acquired during the first year of the Degree.

The focus of the subject for the Graduate in Chemical Engineering is directed to (i) the determination of the heat and work needs involved in physical and chemical processes and (ii) the adequate application of thermodynamic laws for the study of substances pure, of mixtures, of phase equilibrium and chemical equilibrium. Initially, single monocomponent systems will be approached from the thermodynamic point of view. Next, multicomponent systems of greater complexity that are common in the field of Chemical Engineering will be studied.

In this course, concepts and thermodynamic properties are learnt (heat, work, internal energy, enthalpy, Gibbs energy, phase and chemical equilibrium, equilibrium composition, among others), which are essential for other subjects of the Degree in Chemical Engineering related to the design of equipment and facilities.

The descriptors are:


Expected learning outcomes and competences

Specific competences:
- Know the variables and thermodynamic concepts necessary for Chemical Engineering.
- Understand and deduce the Principles of Thermodynamics and their application to the study of pure substances and mixtures.
- Know and calculate the thermodynamic variables by different methods: PVT data, state equations, correlations and thermodynamic diagrams and tables.
- Use thermodynamic laws for the study of pure substances, mixtures, phase equilibrium and chemical equilibrium.
- Define the heat and work needs involved in physical and chemical processes.
- Know the thermodynamics of multicomponent systems, establishing their physical and chemical equilibrium.
Transversal competences:
- Use ICTs applied to advanced level learning, and handle in a basic way the sources of information and specific databases of the modules, as well as office tools to support oral presentations.
- Communicate and transmit, basically, in writing and orally, knowledge, results and acquired skills.
- Solve problems of the common matters of the industrial branch, raised with quality and ethical criteria.

Once these competences have been achieved, the student will be able to apply the essential thermodynamic concepts in the labor world and in other subjects of the Degree in Chemical Engineering. In this sense, Applied Thermodynamics is essential in the following subjects:

- 2nd course: Kinetics of Chemical Processes, Heat Transmission, Practice in Chemical Engineering I.
- 4th course: Energy Engineering

With the passing of this subject, the student will be able to understand and design any physical process from the thermodynamic point of view, thus calculating the thermodynamic properties of ideal and non-ideal systems. In addition, he/she will be able to calculate the equilibrium composition of any chemical system, and establish the dependence of this composition with temperature and pressure.

**Theoretical and practical contents**


**Methodology**

**Types of classroom teaching activities and student work:**

Magisterial or Theoretical Class (20 hours, face-to-face): The professor explains the most relevant thermodynamic objectives and aspects of each topic. For a good assimilation of the concepts and its application, it provides information, bibliography and documentation for the development of the topic. The student assimilates the concepts, takes notes and plans the preparation of the topic. In addition, a proactive attitude is expected in class, raising doubts and complementary questions and answering the questions posed by the teacher. This participation will be taken into account in the final evaluation.

Classroom practice - problems (30 hours, face-to-face): The teacher selects works and model exercises to illustrate the concepts corresponding to the subject. Supervises and supports the problem solving work that the student develops. The student solves selected problems or the proposed works. Present the results on the blackboard or through written reports.
Seminars - classroom tutorials (10 hours, face-to-face): The teacher solves doubts and raises questions to discuss. Analyze the student’s progress and consistency. Recommends work methods in the subject. Proposes work to the group. Guide and moderate the discussion of the results. The student participates actively in this teaching task, raising doubts arising in the scheduled tasks. In addition, it exposes and discusses the results of assignments / problems assigned, orally or in writing, individually or in a group, about the assignments. Your profitable involvement in the seminars will be part of your final mark.

*Types of non-classroom teaching activities and student work:*

Work, at home or in the library, personal and sometimes in groups using the available resources (theoretical classes, practical classes, bibliographical resources). Assimilates the fundamental concepts of each topic.

Solve the questions raised in the practical classes and tutoring. Resolve the issues raised in the Information Platform. Acquire the necessary knowledge for his training as a Chemical Engineer and applies them in a rationalized manner to practical situations.

Search in the library or in other sources, preferably within the recommended bibliography, the necessary information for the expansion of the topics exposed in the theoretical classes and for the resolution of theoretical questions and / or problems. The student acquires skills and abilities in the management of bibliographical resources to complement and strengthen knowledge, striving in the discrimination between issues with basic or secondary importance (ability to synthesize and analyze).

Dedication: 90 hours, 6 hours / Week, 1.2 hours / day

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**Ordinary call: recommendations and resignation**

In the ordinary call, there are two evaluation possibilities: Continuous evaluation and final evaluation.

It is highly recommended to follow the continuous evaluation.

**A) CONTINUOUS EVALUATION**

In the continuous evaluation, the following tasks must be fulfilled:

Problem solving and questionnaires, individual or group formal. Presentations and individual or group work. Short tests (with theoretical and applied contents). Active and profitable participation in the seminars. Use of the ‘egela’ computer platform. These activities constitute 50% of the final mark. Minimum required mark: 4.
Test on the date of the official ordinary call: The test will be about the contents of the subject, differentiating the theoretical contents and the problems. These activities constitute 50% of the final mark. Minimum required mark: 4.

To pass (pass) the subject requires a minimum mark of 5.

In the continuous evaluation, the following aspects will be taken into account:

Clarity in the development and adaptation of theoretical responses. Originality in the approach to solving both theoretical and practical issues. Adequacy of the theoretical concepts used to solve the problem. Clarity in the exposition and the reasoning followed in the resolution of the problem. Validity of the final result in the solving of problems. Participation and follow-up in teaching activities.

B) FINAL EVALUATION

Students will have the right 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 submit in writing to the faculty responsible for the subject the waiver of continuous evaluation. For this, the deadline will be week 11, from the beginning of the semester, according to the academic calendar of the center.

If the student chooses the final evaluation system, he will take an exam that covers the whole subject, on the same date set for the ordinary call test. In this exam, theoretical and practical knowledge will be evaluated, with the minimum score reaching 5 to pass the subject. The following aspects will be taken into account in the final mark: clarity in the presentation of the answers and their validity, providing original answers to the theoretical and practical questions and using appropriate procedures in the resolution

Resignation of the ordinary call

The student who resigns from the call will have the mark of not presented.

In the case of continuous evaluation, students may 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. This waiver must be submitted in writing to the teacher.

When it is a final evaluation, the non-presentation to the test set on the official exam date will automatically waive the corresponding call.
Extraordinary call: orientation

Students who do not pass the subject in the ordinary call, regardless of the chosen evaluation system, will have the right to take exams and assessment activities that make up the final evaluation test of the extraordinary call.

The evaluation of the subject in the extraordinary call will be made exclusively through the final evaluation system, which will mean 100% of the mark of the subject.

The final evaluation test of the extraordinary call will consist of exams and evaluation activities, which are necessary to be able to evaluate and measure the defined learning results, in a comparable manner to how they were evaluated in the ordinary call. The positive results obtained by the students during the course can be taken into consideration. In the case of having obtained negative results through the continuous assessment carried out during the course, these results cannot be maintained for the extraordinary call, in which the students will be able to obtain 100% of the mark.

Resignation of the extraordinary call

Failure to take the test set on the official exam date will automatically waive the corresponding call.

Materials of compulsory use

Thermodynamic tables and diagrams.

Basic bibliography


Complementary bibliography


Specialized journals

Journal of Chemical Thermodynamics
Journal of Chemical and Engineering Data
Fluid Phase Equilibria
Thermochimica Acta

Useful links

http://www.biopsychology.org/apuntes/termodin/termodin.htm
http://www.sc.ehu.es/sbweb/fisica/estadistica/termo/Termo.html
http://www.psigate.ac.uk/newsite/reference/plambeck/chem2/ua102.html
http://thermodex.lib.utexas.edu/
# PROJECT MANAGEMENT

## DETAILS OF THE SUBJECT

<table>
<thead>
<tr>
<th>Degree</th>
<th>Degree in Chemical Engineering</th>
<th>Plan</th>
<th>GUINQUI30</th>
</tr>
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<tbody>
<tr>
<td>Subject</td>
<td>Project Management</td>
<td>Code</td>
<td>ORG.GEST</td>
</tr>
<tr>
<td>Type</td>
<td>Compuls. Term 2º cuatrimestre</td>
<td>Course</td>
<td>Fourth</td>
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## TEACHER

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubén López Fonseca (Head of the subject)</td>
<td>Chemical Engineering Dpt., Building B1, Floor 1, Office B1.P1.15</td>
<td>946015985</td>
<td><a href="mailto:ruben.lopez@ehu.eus">ruben.lopez@ehu.eus</a></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
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<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>José Maria Castresana</td>
<td>Chemical Engineering Dpt., Building B1, Floor 1, Office B1.P1.1</td>
<td>946015553</td>
<td><a href="mailto:josemaria.castresana@ehu.eus">josemaria.castresana@ehu.eus</a></td>
</tr>
</tbody>
</table>
Description and context of the subject

The objective of the topic consists of the acquisition by the student of the necessary knowledge about the terminology, content, structure and development of the project and its application in relation to the professional profiles and competences of the degree.

With the proposed program, the student should:

- Know the professional field of the Chemical Engineer in relation to Project Management.
- Acquire a global vision of Project Management, and master the fundamentals regarding their formulation, morphology and evaluation.
- Know and understand the functions of Project Management.
- Gain proficiency in Project Management techniques.
- Be able to integrate into any work team for the design or management of engineering, business or development projects.

The descriptors are:


Expected learning outcomes and competences

Competences

- Master the phases of writing, planning and management of industrial projects in general and the Chemical Industry in particular.
- Use information and communication technologies applied to advanced learning, and handle basic sources of information, including databases specific to the modules, as well as office tools to support oral presentations.
- Communicate and transmit, basically, in writing and orally, the knowledge, results, skills and abilities acquired in a multidisciplinary and multilingual environment.
- Organize and plan activities, adapting to group work, with recognition of diversity and multiculturalism, critical reasoning and constructive spirit.
- Participate and lead, where appropriate, work groups with critical reasoning and constructive spirit.
- Solve problems of the common matters of the industrial field, raised with criteria of quality, sensitivity for the environment, sustainability, ethical criteria and promotion of peace.
Expected learning outcomes
- Apply the theoretical concepts of Project Management to a practical case.
- Develop an economic feasibility study.
- Make an organization chart / temporal planning of the tasks of a project.

Theoretical and practical contents


LESSON 4. Stages of the project. Feasibility study / preliminary study (Phase I). The preliminary draft (Phase II). Development project (Phase III). Implementation / start-up / operation of the project (Phase IV).


LESSON 6. Purchase management. Hiring of the construction and assembly of the project. Purchase management. Hiring of civil works. Assembly contracting. 'Package LESSONS'. Construction and assembly of the project.


Methodology

The teaching of the subject is composed of different modalities. In the lectures, the main contents of each topic will be discussed. In the classroom classes, the students will perform different practical exercises that will complement the exposed theory. In the seminars, the acquired skills will be complemented by some practical examples or cases to be discussed, usually in groups. In the computer classes, activities related primarily to feasibility studies and project planning will be solved. The students through the realization of a work must apply the acquired knowledge and skills to a project of an industrial installation.

Ordinary call: recommendations and resignation

In ordinary call, the evaluation of the subject will be an average of a written test to be developed and an oral presentation (including the presentation on paper) made in-group. The contributions of the final mark will be 65% and 35%, respectively. The written test will contain two parts, one of a theoretical-applied character and another of a practical nature. The respective contributions will be (60% and 40%). The practical part will focus on an economic feasibility study and a temporary project planning.

Written work
- Oral Presentation (MS Power Point)
- Compulsory attendance of all students to oral presentations
- Discussion time
- Groups of two / three students
- Free theme (to agree with the teachers)

The resignation of this evaluation system must be submitted in writing to the teacher before the end of the ninth week of the course.
Resignation of the ordinary call

The student who resigns from the call will have the mark of not presented.

In the case of continuous evaluation, students may 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. This waiver must be submitted in writing to the teacher.

When it is a final evaluation, the non-presentation to the test set on the official exam date will automatically waive the corresponding call.

Extraordinary call: orientation

The mark will be determined from a single written test that will include issues to develop and problems, taking into account the exposure of the work as a consultant.

To renounce this evaluation system, it is sufficient not to take the exam.

Materials of compulsory use

Materials provided by the teacher and textbooks

Basic bibliography


Complementary bibliography

Degree in Chemical Engineering
Faculty of Science and Technology 2018/2019

CHEMICAL ENGINEERING AND SUSTAINABILITY [IQSOST]

<table>
<thead>
<tr>
<th>Details of the Subject</th>
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</thead>
<tbody>
<tr>
<td>Degree</td>
</tr>
<tr>
<td>Subject</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>ECTS</td>
</tr>
</tbody>
</table>

Teacher

| Name | Beatriz de Rivas Martín |
| Location | Chemical Engineering Dpt., Building B1; Floor 1, Office B1.P1.1 |
| Phone | 94 601 5553 | Email | beatriz.derivas@ehu.eus |
Description and context of the subject

The subject "Chemical Engineering and Sustainability" of 4.5 ECTS, is optional and is taught in the first four-month period of the fourth year. This subject aims to bring the student to the current status and future approaches in the chemical industry, where the variable environment should also be considered in the design of processes along with the rest of the variables. A special attention is paid to the environmental aspects and impacts of chemical processes and a vision of European actions focused on sustainable development is given.

Expected learning outcomes and competences


- CM01 - Apply the knowledge acquired to the development of innovative technologies and processes in strategic sectors of the Chemical Industry, focused on renewable energy, environment and border fields.
- CM04 - Handle skillfully the sources of information and databases related to the specific subjects studied in the intensification module, as well as office tools to support oral presentations.
- CM05 - Communicate and transmit, effectively, in writing and orally, the knowledge, results, skills and abilities acquired in a multidisciplinary and multilingual environment.
- CM06 - Organize, plan and lead activities in working groups, with recognition of diversity and multiculturalism.
- CM08 - Solve specific problems of the studied subjects, propose alternative problems, all of them raised with criteria of quality, sensitivity to the environment, sustainability, ethical criteria and promotion of peace.

Theoretical and practical contents

LESSON 1.- BASIC CONCEPTS OF SUSTAINABLE CHEMISTRY. Principles of “Green” Chemistry.
Sustainability Parameters

LESSON 2.- ATOMIC ECONOMY. Performance of a Process. Types of Chemical Reactions. Examples of Processes
LESSON 3. - CATALYSIS IN SUSTAINABLE CHEMISTRY. Concept of Catalysis. Concept of Selectivity and types of Selectivity. Heterogeneous and Homogeneous Catalysis. Industrial Catalytic Applications.


Methodology

Prior to the master classes, where the teacher will develop the contents of the different topics raised, the student will have, through the e-gela platform, the graphic material used, as well as documents of interest related to the subject. During the seminar classes, students in small groups will solve small questions raised by the teacher or inquire about some topic.

Ordinary call: recommendations and resignation

In the case of continuous evaluation, the evaluation would be according to:

FINAL EXAM: 50% OF THE FINAL MARK (minimum mark to be obtained: 4.0)

REALIZATION OF PRACTICAL CASES AND WRITTEN REPORTS (SEMINARS): 20% OF THE FINAL MARK

WORK (REPORT, ORAL EXPOSURE): 30% OF THE FINAL MARK

The student who wishes to renounce the continuous evaluation and choose the final evaluation must communicate it in writing to the teacher before week 9.

In the case of continuous assessment, students may 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 subject. This waiver must be submitted in writing to the teacher.
Extraordinary call: orientation

The evaluation is through a FINAL EXAM (100%). It is considered that the student waives the call if they do not take the final exam.

Materials of compulsory use

Materials provided by the teacher

Basic bibliography


Complementary bibliography


Journals
Green Chemistry
The International Journal of Life Cycle Assessment
Catalysis Today

**Internet addresses of interest**

http://www.epa.gov/
http://www.pte-quimicasostenible.org/
http://www.usc.es/biogrup/redciclovida.htm
http://lct.jrc.ec.europa.eu/
http://feique.org
http://eippcb.jrc.es
## SUBJECT

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>General Chemistry</th>
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## ECTS Credits

| Credits | 6 |

## Plan

| Plan Code | GQUIMI30 - Bachelor’s Degree in Chemistry |

## Cycle

| Cycle Code | Indiferente |

## Year

| Year Code | First year |

## DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

Building upon the knowledge and capabilities already acquired by the student in his/her previous studies; this course focuses on the micro- and macroscopic properties of the elements and their compounds as well as on the different theories of the chemical bond and reactivity. The student will also learn the rules of nomenclature and formulation of both organic and inorganic compounds as well as basic concepts of isomerism in organic materials and the reactivity of the most important functional groups in organic chemistry.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

On completion of the course the student should:

1. Be acquainted with the nomenclature and formulation of both organic and inorganic compounds.
2. Understand the concept of stoichiometry in chemical reactions.
3. Show a deep understanding of the fundamental concepts on chemical bonding and the structure of matter.
4. Be familiar with the basic concepts on the structure and reactivity of the most common chemicals, both organic and inorganic.
5. Be capable of connecting concepts from the different experimental sciences in order to explain chemical phenomenology and the transformation of matter in general.
6. Be acquainted with the most common sources of information in the experimental sciences.

## THEORETICAL/PRACTICAL CONTENT

7. Stoichiometry in chemical reactions. Molecular weight and formula calculation. The concept of mol. The chemical equation.

## METHODS

The teaching will be given as lectures (30 hours), classroom practices - consisting of solving problems and answering questions - (25 hours) and seminars (5 hours), which delve into various key aspects of the subject.
TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
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<tbody>
<tr>
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</table>

Legend:
- M: Lecture
- S: Seminario
- GA: Pract. Class. Work
- GL: Pract. Lab work
- GO: Pract. Computer work
- GCL: Clinical Practice
- TA: Workshop
- TI: Ind. Workshop
- GCA: Field Workshop

ASSESSMENT SYSTEMS
- Continuous assessment system
- Final assessment system

TOOLS USED & GRADING PERCENTAGES
- Extended written exam 70%
- Practical work (exercises, case studies & problems set) 30%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The final grade will result from the combination of:
- Marks from the problems and assignments throughout the duration of the course (30 %, minimum grade: 4.0/10).
- Final test (70%, minimum grade: 4.0/10)

The student will also have to pass a test on formulation and nomenclature in order to pass the course.
On marking, particular attention will be paid to:
- Demonstrating a well-structured reasoning for solving questions and problems related to the subject.
- The accuracy, clarity and consistency of the given answers.

Within this evaluation model (30/70), homework and assignments are mandatory. However, did the student wish not to be evaluated this way, he is entitled a single final test (100 %) on the January call. In order to do so, he/she must present his/her renounce letter to the member of the academic staff responsible for the course before week 9. His/her non-attendance the day of the exam will be considered as a renounce.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The final grade is derived here entirely from the mark obtained in the exam (100%).

COMPULSORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

In-depth bibliography
- L. Smart y E. Moore, "Química del estado sólido, una introduccion". Addison-Wesley, 1995.
Journals
Journal of Chemical Education

Useful websites
http://webbook.nist.gov/chemistry
http://www.chem.ox.ac.uk/vrchemistry/
http://www.800mainstreet.com/1/0001-000-TOC.html
http://www.webelements.com/

REMARKS
### TEACHING GUIDE

**Centre**: 310 - Faculty of Science and Technology  
**Cycle**: Indiferente  
**Plan**: GGELO30 - Bachelor’s Degree in Geology  
**Year**: Fourth year  
**ECTS Credits**: 6

### SUBJECT

26797 - Micropaleontology

### DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

A microfossil is a fossil that, due to its small size (mm or microns), can only be studied with a binocular microscope or through an optical or scanning electron microscope. Microfossils may correspond to whole organisms or fragments of the hard parts of larger organisms. The microfossils of animals or their parts are known as microfauna (for example, ostracods and teeth of micromammals) although this term is also used for some microfossils of protists (for example, foraminifera). Plant microfossils, usually from fossilization of phytoplankton, are called microflora (for example, diatoms and dinoflagellates).

The science that is responsible for the study of microfossils is called Micropalaeontology. The techniques to study microfossils are diverse, depending on the group being studied and the sediment or rock types in which it is found, but the most common is the wet screening when we are dealing with organisms preserved in soft sediments.

Some microfossil groups are of great importance as palaeoenvironmental proxies and others as biostratigraphic markers, both in marine and continental sedimentary series of different ages.

### COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

**Objetives:**

- To know the conceptual bases of Micropalaeontology.
- To know the morphological and palaeoenvironmental characteristics as well as the evolutionary history of the main microfossil groups and to use them in the resolution of geological problems.

**Specific competences:**

- To use correctly the terminology, nomenclature, agreements and units that are common in the field of Micropalaeontology.
- To learn how to describe and know the evolutionary history of the main microfossil groups.
- To know how to apply this knowledge in solving geological problems.

**Transversal competences:**

- Ability to search and manage information.
- Ability to plan and manage time.
- Ability to apply knowledge to practice.
- Ability to communicate orally and written in the native language.
- Critical and self-critical capacity that allows the student to evaluate the work produced, in order to maintain its quality.

### THEORETICAL/PRACTICAL CONTENT

METHODS

PRACTICAL CONTENTS:
- Field trip: collection of samples in an area of geological interest.
- Laboratory work: preparation of samples collected in the field and microfossil analysis in order to perform a palaeoenvironmental and biostratigraphic interpretation of the sedimentary record.
- Bibliographic or practical guided work: development of theoretical or practical works on a subject of micropalaeontological interest that will be presented orally later in class.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
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<th>GO</th>
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ASSESSMENT SYSTEMS

- Final assessment system

TOOLS USED & GRADING PERCENTAGES

- Extended written exam 70%
- Practical work (exercises, case studies & problems set) 20%
- Individual work 5%
- Exposition of work, readings, etc. 5%

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

A. Evaluation during the academic course:
- Laboratory practices and field trip: evaluation of the notebook of practices carried out along the academic course and of the exercises for the resolution of associated geological problems, as well as of the annotations made in the field notebook (5%).
- Oral presentation: evaluation of the scientific level, structure and presentation of a bibliographic work carried out in relation to some aspects of the contents (5%).

B. Final examination of theoretical contents (70%) and laboratory practices (20%).

These evaluation criteria will be applicable for both the ordinary and the extraordinary calls.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

A. Evaluation during the academic course:
- Laboratory practices and field trip: evaluation of the notebook of practices carried out along the academic course and of the exercises for the resolution of associated geological problems, as well as of the annotations made in the field notebook (5%).
- Oral presentation: evaluation of the scientific level, structure and presentation of a bibliographic work carried out in relation to some aspects of the contents (5%).

B. Final examination of theoretical contents (70%) and laboratory practices (20%).

These evaluation criteria will be applicable for both the ordinary and the extraordinary calls.

COMPULSORY MATERIALS

- Laboratory for treatment of samples collected during the field trip.
- Laboratory (chemical products: methylene blue, rose bengal, trichlorethylene, hydrogen peroxide, multiple slides, needles, brushes, picking trays, etc.) and field (sampling bags, labels, permanent markers, etc.) consumables.
- Optics laboratory (binocular microscopes).
BIBLIOGRAPHY

Basic bibliography


In-depth bibliography


Journals

- Journal of Foraminiferal Research
- Journal of Micropalaeontology
- Marine Micropalaeontology
- Micropalaeontology
- Palaeogeoography
- Palaeoclimatology
- Palaeoecology
- Paleceanography
- Palynology
- Review of Palaeobotany and Palynology
- Revista Española de Micropaleontología

Useful websites

- Cushman Foundation: //www.cushmanfoundation.org/
- eForams website: //www.eforams.org/
- Foraminifera Gallery: //www.foraminifera.eu/
- Grzybowski Foundation: //www.es.ucl.ac.uk/Grzybowski/
- Micropalaeontology Press: //micropress.org/
- Micropalaeontological Society: //www.tmsoc.org/
- MIRACLE (microfossil image recovery and circulation for learning and education): http://www.ucl.ac.uk/GeolSci/micropal/welcome.html
- North American Micropalaeontology Section, SEPM: //www.sepm.org/nams/micro.htm
- Revista Española de Micropaleontología: //www.igme.es/
- The Curator of Micropalaeontology Blog: //www.nhm.ac.uk/natureplus/blogs/micropalaeo/

REMARKS

- This subject has a linked moodle course, also called Micropalaeontology (https://egela.ehu.eus), for communication and exchange of materials between lecturer and students.

- This subject of the Bachelor Degree in Geology is included in the TMS Student Award scheme of the Micropalaeontological Society. The student who best develops her/his academic tasks during each academic year will receive a free subscription to the Micropalaeontological Society for a year, will be able to participate in its activities, and
will receive the journals and internal bulletins of this society.