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

### English Friendly Courses taught in SPANISH:

<table>
<thead>
<tr>
<th>FACULTY OF ENGINEERING - VITORIA-GASTEIZ (163)</th>
<th>COURSE</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
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<tbody>
<tr>
<td><strong>Common Courses for Industrial Branch</strong></td>
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<tr>
<td>25974 Fundamentos Físicos de la Ingeniería</td>
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<tr>
<td>25975 Fundamentos Químicos de la Ingeniería</td>
<td>Annual</td>
<td>9</td>
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<tr>
<td>25984 Mecánica Aplicada</td>
<td>Annual</td>
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<tr>
<td>25980 Fundamentos de Tecnología Eléctrica</td>
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<td>9</td>
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<tr>
<td>25979 Mecánica de Fluidos</td>
<td>Jan. 2022- May 2022</td>
<td>6</td>
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<tr>
<td>25985 Sistemas de Producción y Fabricación</td>
<td>Jan. 2022- May 2022</td>
<td>6</td>
<td>A</td>
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</tr>
<tr>
<td><strong>Bachelor's Degree in Industrial Electronics and Automation Engineering</strong></td>
<td></td>
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<tr>
<td>28126 Cálculo y Diseño de Estructuras Automovilísticas</td>
<td>Sep. 2021 - Jan. 2022</td>
<td>6</td>
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<td>25999 Informática Industrial</td>
<td>Sep. 2021 - Jan. 2022</td>
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<tr>
<td>28134 Aerodinámica</td>
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<tr>
<td>26005 Sistemas Empotrados</td>
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<td>28132 Simulación y Análisis FEM en Automoción</td>
<td>Jan. 2022- May 2022</td>
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<tr>
<td>25996 Sistemas Electrónicos Digitales</td>
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<tr>
<td>26007 Control por Computador</td>
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<tr>
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<tr>
<td>26045 Elasticidad y Resistencia de Materiales</td>
<td>Sep. 2021- Jan. 2022</td>
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<tr>
<td>26046 Cinemática y Dinámica de Máquinas</td>
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<tr>
<td>26050 Instalaciones y Máquinas Hidráulicas</td>
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<tr>
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<td>26095 Gestión de residuos industriales</td>
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<td>28138 Procesos de Fabricación en Tecnología Automotriz</td>
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<td>COURSE</td>
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<tr>
<td>28141 Automatización avanzada en fabricación de automóviles</td>
<td>Sep. 2021 - Jan. 2022</td>
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<tr>
<td>28122 Introducción a la Mecánica</td>
<td>Jan. 2022- May 2022</td>
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<tr>
<td>Bachelor's Degree in Computer Management and Information Systems Engineering</td>
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<tr>
<td>26031 Programación Básica</td>
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<td>26018 Arquitectura de Computadores</td>
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<tr>
<td>26021 Lenguajes, Computación y Sistemas Inteligentes</td>
<td>Sep. 2021- Jan. 2022</td>
<td>6</td>
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<tr>
<td>26023 Investigación Operativa</td>
<td>Sep. 2021- Jan. 2022</td>
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<tr>
<td>26025 Sistemas de Gestión de Seguridad de Sistemas de Información</td>
<td>Sep. 2021- Jan. 2022</td>
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<tr>
<td>26036 Desarrollo de Sistemas Gráficos</td>
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<td>26013 Metodología de la Programación</td>
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<td>26027 Sistemas de Apoyo a la Decisión</td>
<td>Jan. 2022 - May 2022</td>
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<td>26029 Sistemas Web</td>
<td>Jan. 2022 - May 2022</td>
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<tr>
<td>26030 Administración de Bases de Datos</td>
<td>Jan. 2022 - May 2022</td>
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<td>26006 Ampliación de Informática Industrial</td>
<td>Jan. 2022 - May 2022</td>
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<tr>
<td>26017 Ingeniería del Software</td>
<td>Jan. 2022 - May 2022</td>
<td>6</td>
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</table>

**English Friendly Courses taught in BASQUE:**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
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<tbody>
<tr>
<td>Bachelor's Degree in Automotive Engineering</td>
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<tr>
<td>28140 Ibilgailu Elektrikoak eta Hibridoak</td>
<td>Sep. 2021- Jan. 2022</td>
<td>6</td>
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</tr>
</tbody>
</table>

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1 SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30.
By clicking the subject’s name, its Syllabus will appear.
Centre | University College of Engineering of Vitoria-Gasteiz  
---|---
Name of subject | 25974 – Physical Foundations of Engineering  
Qualification | Degree in Industrial Electronical and Automation Engineering  
Brief description of the subject content | Fundamentals of mechanics, thermodynamics, fields, electromagnetism and waves  
Type | Compulsory  
Credits | 12 ECTS  
Year | 1  
Term(s) | 1st and 2nd  
Department | Applied Physics I  
Language | Spanish and Basque

### Outcomes / Objectives

Description: Fundamentals of mechanics, thermodynamics, fields, electromagnetism and waves.

Learning outcomes to be achieved:

1.- Establish dimensional relations between different physical magnitudes and correctly use the International Unit System within the scope of the subject.

2.- Use the fundamental laws of physics to explain natural phenomena and the basic operation of machines and devices within the scope of the subject.

3.- Apply the fundamental laws of physics to the solution of practical problems and interpret the results within the scope of the subject.

4.- Adapt the fundamental laws of physics and their scope of validity to different technological applications within the scope of the subject.

5.- Design physical models and define their restrictions for the experimental testing of phenomena or procedures within the scope of the subject.

6.- Estimate the uncertainty in any measurement and in the results of physical calculations, and to treat experimental data to obtain quantitative cause and effect relationships within the scope of the subject.

### Syllabus


5.- General dynamics of particles: Equations of motion. Linear momentum, angular momentum, work and energy. Conservation theorems and principles: Conservative forces. Central forces.

6.- Oscillatory motion: Simple harmonic motion, damped and forced oscillations


17.- Stationary electric currents: Current intensity and density. Electromotive force. Ohm’s, Joule’s and Kirchhoff’s Laws. RC circuits.


19.- Magnetostatic interaction in matter: Diamagnetic, paramagnetic and ferromagnetic materials.


**Methodology**

**Teaching Method**

<table>
<thead>
<tr>
<th>Face-to-Face Teaching Hours</th>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
<th>Computer sessions</th>
<th>Clinical practice</th>
<th>Workshops</th>
<th>Industrial workshops</th>
<th>Field practice</th>
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<tbody>
<tr>
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<td>12.0</td>
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</table>

<table>
<thead>
<tr>
<th>Student Hours of Non Face-To-Face Activities</th>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
<th>Computer sessions</th>
<th>Clinical practice</th>
<th>Workshops</th>
<th>Industrial workshops</th>
<th>Field practice</th>
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<td>18.0</td>
<td>18.0</td>
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</tr>
</tbody>
</table>

**Clarification regarding the methodology**

Classroom instruction will develop the subject matter content and include practical exercises.

Some classroom practice sessions (<strong>GA</strong>) will include laboratory methods, consisting of the study of the measurement theory and an introduction to the handling of experimental data.

Students are expected to study the subject matter content developed in class and solve the proposed exercises. Continuous use of tutorials is recommended. Student hours of non face-to-face activities are indicative only.
**Assessment System**

**General criteria**
1. Written essay exam
2. Practical activities (exercises, cases or problems)

**Clarification regarding assessment**
Continuous and individual. The final overall grade for the subject will be between 0 and 10; the pass mark is 5 points or more. The final grade is calculated as follows:
1. The five best marks achieved in the six control tests account for 25%.
2. A test on experimental laboratory methods accounts for 10%.
3. A final test on the entire content matter of the subject accounts for 65%.

A voluntary partial test will be held at the end of the first semester, which will yield a partial grade by adding the overall mark achieved in the first three control tests with a weighting of 25% plus the mark achieved in this partial test with a weighting of 75%. If the partial grade is equal to or higher than 5, students will have the option of either sitting the final exam based on the entire content of the subject matter or based only on the part taught in the second semester; if the partial grade is less than 5, students must sit the final exam based on the entire content of the subject matter, and in calculating the final overall grade for the subject the partial grade achieved will not be taken into account, however the marks achieved in the first three control tests will count towards the final grade.

In order to ensure that the laboratory practice exercise and control tests are worth 35% of the final grade, students must comply with the following two requirements: (1) They must have performed all the control tests and the laboratory exercise (except for justified reasons). (2) They must have achieved a minimum mark of 3 out of 10 in the final exam. Where both requirements are not fulfilled, the final overall grade for the subject will be based on the mark achieved in the final exam only.

In the re-sit exam session students may only sit for the final exam, and the marks achieved in the control tests and laboratory exercise will be maintained, as well as the two previously established requirements.

More details and assessment criteria will be provided at the beginning of the academic year, and these will remain posted on the notice boards and on the Virtual Campus (Moodle) throughout the year.

**Bibliography**

**Basic Bibliography**

**In-depth Bibliography**
- Giancoli D.C. (2009), Física para Ciencias e Ingeniería con Física Moderna. Pearson Educación.
- Feynman, Leighton y Sands. Física (The Feynman Lectures on Physics). Addison-Wesley Iberoamericana
- Other publications which will be proposed for each part of the subject matter during the course.

**Websites**
- http://www.sc.ehu.es/sbweb/fisica/default.htm
- http://www.fisicahoy.com/
COURSE GUIDE 2021/22

Faculty 163 - Faculty of Engineering - Vitoria-Gasteiz
Degree GIEIAU10 - Bachelor's Degree in Industrial Electronics and Automation Engineering
Cycle Not Applicable
Year First year

COURSE
25975 - Chemical Fundamentals of Engineering
Credits, ECTS: 9

COURSE DESCRIPTION
Chemical Principles of Engineering enables students to acquire basic skills on the structure, properties and behavior of materials. This would make it possible to establish essential relationships between materials' structure and their properties, as well as an understanding of certain industrial processes.

Chemical Principles of Engineering is a compulsory subject (9 ECTS credits) taught at the Faculty of Engineering Vitoria-Gasteiz in the first year of the following degrees: Bachelor in Industrial Electronic Engineering and Automatics, Bachelor in Mechanical Engineering, Bachelor in Industrial Chemical Engineering, and the double bachelor's degree in Mechanical Engineering and Business Administration and Management.

This subject serves as the basis for several subsequent subjects taught at the Bachelors in Industrial Electronic Engineering and Automatics, and in Mechanical Engineering, such as Materials Science (2nd year) or Environmental Technologies (4th year). With respect to the Bachelor in Industrial Chemical Engineering, the acquisition of the skills associated with this subject is of utmost importance regarding the subsequent tackling of specific courses, such as Controlling and Instrumenting Chemical Processes, Experimentation in Chemical Engineering I and II, Physical Chemistry, Chemical Reaction Engineering, Unit Operations or Analytical Chemistry.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCES

SPECIFIC COMPETENCES

FB4. Ability to understand and apply the basic knowledge of principles of general chemistry, organic and inorganic chemistry, and their applications in engineering.

FB7. Ability to apply strategies of scientific method: analyze a problematic situation qualitatively and quantitatively, propose hypotheses and solutions using appropriate models.

FB8. Ability to communicate effectively the knowledge, procedures, results, skills and issues relating to basic engineering subjects, using appropriate vocabulary, terminology and means.

TRANSVERSAL COMPETENCES

FB10. Adoption of a responsible and ordered attitude at work, prepared to a lifelong learning experience.

LEARNING OUTCOMES

1. Know and apply models of the structure of the matter to understand the properties and behavior of substances and materials (FB4).

2. Know and understand the basic principles and theories about the physical and chemical processes that chemical substances can undergo under certain conditions in order to determine, in each case, the effects produced (FB4).

3. Resolve problems and/or laboratory experiences reasonably, including writing accurate lab-reports (FB7).

4. Communicate and transfer knowledge, procedures and results by using the specific terminology of chemical engineering (FB8).

5. Adopt a responsible and ordered attitude and a positive learning readiness (FB10).

6. Acquire knowledge and learning strategies that enable to progress in subsequent studies (FB10).

CONTENIDOS TEÓRICO-PRÁCTICOS

UNIT I. BASIC PRINCIPLES
- Nomenclature of inorganic chemistry.
- States of matter.
- Basic concepts (atomic mass, mole concept, molar mass, etc.).
- Determination of chemical formulas (empirical and molecular formulas).
- Stoichiometry of chemical reactions.

UNIT II. ATOMIC AND MOLECULAR STRUCTURE
- Current model of the atom.
- Electronic structure.
- Periodic table. Periodic properties.
- Chemical bonding and properties of compounds.

UNIT III. AGREGATE STATES OF MATTER. PHASE EQUILIBRIA
- Gaseous state.
- Liquid state.
- Solid state.
- Equilibrium phase diagram.

UNIT IV. THERMOCHEMISTRY
- First principle of thermodynamics.
- Processes of energy exchange with and without phase change.
- Heat of reaction.

UNIT V. SOLUTIONS. COLLIGATIVE PROPERTIES
- Solutions.
- Colligative properties.
- Volatile solutes in solution.

UNIT VI. BASIC PRINCIPLES OF ORGANIC CHEMISTRY
- Nomenclature of organic compounds. Functional groups.

UNIT VII. KINETICS OF CHEMICAL REACTIONS
- Basic concepts of chemical kinetics: reaction rate, reaction order and reaction law.
- Simple kinetics models: zero, first and second order reactions.
- Effect of temperature. Arrhenius equation.
- Introduction to catalysis.

UNIT VIII. CHEMICAL EQUILIBRIUM
- Thermodynamic principles of chemical equilibrium.
- Le Chatelier's principle.
- Electrolyte solutions.

UNIT IX. EQUILIBRIUM IN AQUEOUS SOLUTIONS
- Acid-base equilibrium.
- Precipitation reactions.
- Redox reactions and electrochemistry.

**TEACHING METHODS**

**PRESENTIAL ACTIVITIES**

**THEORETICAL CLASSES (45 h)**

During the 30 weeks of the academic year, concepts and theoretical developments will be taught in a weekly session (1.5 h). Explanations will be complemented with standard exercises and activities that will allow the acquisition of established skills.

**CLASSROOM PRACTICES (30 h)**

During the 30 weeks of the academic year, resolution of exercises and practical activities will be carried out in a weekly session (1.0 h).

**LABORATORY PRACTICES (15 h)**

Students must complete 5 laboratory practices of 3 hours each. Lab sessions will be taught in the Basic Chemistry laboratory of the Faculty of Engineering Vitoria-Gasteiz, according to the calendar and schedule proposed for each group.

The practices will be carried out individually, as long as the available material allows it. Otherwise, the practices will be
Evaluation tools and percentages of final mark carried out in pairs, which will allow, additionally, to promote other skills, such as teamwork.

Each student must submit a deliverable before the beginning of each practical session, in which several questions related to the practice must be answered. At the end of the practical session, the students must take a test related to the content of the practice. Finally, the students will have one week to submit a final deliverable containing the results obtained and the main conclusions of the practice.

TUTORSHIP SESSIONS

In general, it is a voluntary activity (individual or collective) conducted in response to students' request. However, throughout the course a series of voluntary group deliverables will be proposed that will require attendance at tutorials.

NON-PRESENTIAL ACTIVITIES (135 h)

Continued work of student is essential to develop the competences of the subject. In addition to preparing the written exams, students should devote the hours of non-presential teaching to:

- Complete notes, consult bibliography and solve questions and/or problems, including voluntary deliverable tasks (a time commitment of approximately 2-3 h per week).

- Prepare the laboratory sessions (a time commitment of 1.5-2.0 h to prepare the laboratory practice and answer a set of preliminary questions per practice) and complete the corresponding report (2.0-2.5 h commitment per practice).

*If the extraordinary circumstances derived from the current public health emergency situation caused by the outbreak of COVID-19 oblige to develop online teaching, all media available in the UPV/EHU (BlackBoard Collaborate, eGela, etc.) will be used.

<table>
<thead>
<tr>
<th><strong>Types of teaching</strong></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><strong>Hours of face-to-face teaching</strong></td>
<td>45</td>
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</table>

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

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

Evaluation tools and percentages of final mark
- Written test, open questions 70%
- Exercises, cases or problem sets 15%
- Laboratory practices 15%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EVALUATION SYSTEM

WRITTEN TEST/EXAM (70% of the final mark)

The written test will comprise two partial tests:
- The first partial examination includes the contents taught during the first four-month period (September to December).
- The second partial examination includes the contents taught during the second four-month period (February to May).

The final mark is calculated as the simple average of the marks obtained in both partial tests, provided that a mark equal to or greater than 4 has been attained in each of them.

In addition, on the date established by the Faculty for the ordinary exam call, a final test will be held in which:

a) Students who have not obtained a mark equal to or greater than 4 out of 10 in any of the partial tests, will take the exam of the failed partial. In this case, the final grade corresponding to the written test will be calculated as the simple average of the marks of the two partial tests (provided that both have obtained a mark equal to or greater than 4).

b) Students who have not taken the partial tests, or have obtained a grade lower than 4 in both of them, will take an exam including the whole subject. In this case, the exam will consist of two different parts, each corresponding to the contents
taught in each period. The final mark corresponding to the written test will be calculated as the simple average of the marks obtained in the two parts. It is compulsory to obtain a mark equal to or greater than 3.5 out of 10 in both parts.

PRACTICAL ACTIVITIES (15% of the final mark)

Practical activities will be undertaken throughout the course, such as problem solving and cases, written tests, questionnaires, amongst others.

LABORATORY PRACTICES (15% of the final mark)

- Laboratory work: 25%
- Presentation and evaluation of the previous deliverables: 15%
- Evaluation test (after each lab-session): 25%
- Presentation and evaluation of the final deliverables: 35%

REQUIREMENTS to pass the subject:

- Complete all the laboratory practices and submit the previous deliverables/questionnaires, post-practice evaluation tests and the final deliverables/questionnaires within the deadline.
- Obtain a mark equal to or greater than 5 in the final mark (obtained as a weighted average of the marks corresponding to the written test, practical activities and laboratory practices).
- Obtain a mark equal to or greater than 4 out of 10 in all activities (i.e., written test, practical activities and laboratory practices).

Those students who do not meet any of these requirements will be graded with a 4 (maximum) in the corresponding report, regardless of the final mark obtained.

*If the extraordinary circumstances derived from the current public health emergency situation caused by the outbreak of COVID-19 oblige to develop an online evaluation, all media available in the UPV/EHU (BlackBoard Collaborate, eGela, etc.) will be used. The characteristics of this new evaluation mode will be published in eGela.

CALL RESIGNATION

Students may waive the extraordinary call simply by not showing up for the final test.

FINAL TEST

Students who meet the conditions established in the UPV/EHU regulations and request to take a final test within the deadline set for that purpose (Chapter II, Article 8 of the Agreement of December 15, 2016, of the Governing Council of the University of the Basque Country/Euskal Herriko Unibertsitatea, which approves the Regulations governing the students’ Evaluation in official Bachelor's degrees), they need to implement the following activities:

a) A written test related to the theoretical-practical contents of the subject (85% of the final mark).

b) A practical laboratory exam (15% of the final exam).

REQUIREMENTS to pass the subject (FINAL TEST)

Obtain a mark equal to or greater than 5 in the final grade (obtained as the weighted average of the marks corresponding to the written test and the practical exam).

*If the extraordinary circumstances derived from the current public health emergency situation caused by the outbreak of COVID-19 oblige to develop an online evaluation, all media available in the UPV/EHU (BlackBoard Collaborate, eGela, etc.) will be used. The characteristics of this new evaluation mode will be published in eGela.

CALL RESIGNATION

Students may waive the extraordinary call simply by not showing up for the written test or the practical laboratory exam.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation criteria in the extraordinary call will be:

a) A written test related to the theoretical-practical contents of the subject (85% of the final mark).

b) A practical laboratory exam (15% of the final exam). A student will be exempt from this exam if all the laboratory
practices throughout the course are completed and a mark higher than 5 is obtained.

REQUIREMENTS to pass the subject

Obtain a mark equal to or greater than 5 in the final mark (obtained as the weighted average of the marks corresponding to the written test and the practical exam or laboratory practices).

*If the extraordinary circumstances derived from the current public health emergency situation caused by the outbreak of COVID-19 oblige to develop an online evaluation, all media available in the UPV/EHU (BlackBoard Collaborate, eGela, etc.) will be used. The characteristics of this new evaluation mode will be published in eGela.

CALL RESIGNATION

Students may waive the extraordinary call simply by not showing up for the final test.

MANDATORY MATERIALS

- Collections of problems and specific questions related to the subject.

BIBLIOGRAFÍA

Basic bibliography

NOMENCLATURE OF INORGANIC CHEMISTRY

GENERAL CHEMISTRY

LABORATORY PRACTICES

Detailed bibliography
Web sites of interest
http://www.egela.ehu.es
http://www.ptable.com/?lang=es

OBSERVATIONS
DESCRIPTION AND CONTEXTUALIZATION OF THE SUBJECT.

The objective of Applied Mechanics is to establish knowledge and skills related to the Statics, Kinematics and Dynamics of rigid solids. These ideas will serve as a scientific-technical basis for the engineers in the industrial area. Applied Mechanics has a very close relationship with Physics and Mathematics, and will serve to broaden the physical sense of the students. The course will serve to develop the analytical ability to divide a problem into simpler parts, so that once the parts are understood to be able to solve the problem as a whole. The concepts of this subject are within the field of vector calculus and matrix algebra, so the skills acquired in the Physics, Calculus and Algebra subjects will be necessary to be able to solve the problems numerically and symbolically.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCES / LEARNING OUTCOMES OF THE SUBJECT.

The object of the course is to establish the precise knowledge and skills on the statics, kinematics and dynamics of rigid solids, which serve as the basis for the disciplines that incorporate the theory of mechanisms and machines and the resistance of materials. Intimately connected with physics and mathematics, mechanics should contribute to increase the physical and practical sense of the students, providing them with a synthetic analytical capacity that allows them to decompose problems into simple parts and then relate them, once they have been established dependencies.

The learning Outcomes of the Subject Matter:
- C.1 Be able to analyse mechanical phenomena in the field of statics, kinematics and dynamics.
- C.2 Be able to choose the most appropriate and efficient resolution tools to solve mechanical problems in the previous field and under the rigid body hypothesis.
- C.3 Be able to assess the need for simplification of the real system and the adequacy of mathematical models of mechanical systems.
- C.4 Be able to interpret the results of mechanical analyzes and their adaptation to reality.
- C.5 Be able to distribute, interact and present a problem, its resolution and its results in a working group orally and in writing.

CONTENIDOS TEÓRICO-PRÁCTICOS

THEORETICAL AND PRACTICAL CONTENTS

Topic 1 VECTORS Assuming prior knowledge of the concept of vector, we will focus basically on the study of vector systems.
Topic 2 GEOMETRY OF MASSES Distribution of matter in geometric spaces through the concepts of center of mass and first and second order moments.
Topic 3 STATICS Concept of equilibrium in mechanical systems. Active forces and bonding forces, smooth bonds and rough bonds.
Topic 5 DYNAMICS Laws of dynamics. Theorems of dynamics, for the point and for material systems.

TEACHING METHODS

METHODOLOGY

In the theoretical classes the theory will be explained and related examples will be solved. In the classroom practices can explain theoretical concepts and propose exercises to develop.
TYPES OF TEACHING

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

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

Evaluation tools and percentages of final mark

- End-of-course evaluation
- Written test, open questions 80%
- Exercises, cases or problem sets 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

ORDINARY CALL.

Evaluation is based on a continuous frame as follows:

The written tests to develop are detailed below:

Three partial exams:
1) Vectors. Mass geometry. Static
2) Kinematics.
3) Dynamic. Introduction to the resistance of materials.

The passing of each partial releases the subject. Students will sit for the non-passed parts in the final exams.

The final grade of the exams will be the average of the three parts.
Who does not appear to the final exam, will obtain a grade of not presented.

The deliverables to be performed will consist of different tasks that will be described throughout the course. Some must be done individually, others in a group. Some of them will be face-to-face and will be held in class and others will be non-face-to-face.

In the event that a face-to-face assessment of the subject cannot be carried out, the pertinent changes will be made to carry out an on-line assessment by using the existing IT tools at the UPV / EHU. The characteristics of this online assessment will be published in the student guides and in eGela.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXTRAORDINARY CALL

The final exams will be attended with pending material.
The final mark of the exams will be the average of the three parts.
Whoever does not appear for the final exam, will obtain a grade of not presented.

MANDATORY MATERIALS

MANDATORY USE MATERIALS

Theory and problems explained during lectures.

BIBLIOGRAFÍA

Basic bibliography
- GONZALO, G.C. Problemas para un curso de mecánica. Edit: UPV-EHU.
- Apuntes del profesor
- BEER, F.P.;RUSSELL,E. Mecánica vectorial para Ingenieros. (Tomos I y II) Edit: MacGraw-Hill
- HIGDON; STILES. Ingeniería Mecánica. (Tomos I y II) Edit: Prentice-Hall Inc.
- MERIAM, J.L. Mecánica (Tomos I y II) Edit: Reverté
- Joseba García Melero. Resistencia de Materiales. Editorial: UPV-EHU

Detailed bibliography
- BASTERO, J.M.; CASELLAS, J. Curso de Mecánica Edit: EUNSA
- Manuel Vazquez. Resistencia de Materiales. Editorial: Universidad Politécnica de Madrid
- Timoshenko. Resistencia de Materiales (2 tomos). Editorial: Espasa-Calpe

Journals

Web sites of interest
http://www.vc.ehu.es/ingme
http://egela.ehu.eus
http://www.biblioteka.ehu.eus

OBSERVATIONS
Fluid Mechanics is a key subject of the Second grade in Industrial Engineering in the University College of Engineering at Vitoria-Gasteiz with 6 ECTS credits.

Fluid Mechanics deals with the study of all fluids under static and dynamic situations. Fluid Mechanics is a branch of continuous mechanics which deals with a relationship between forces, motions, and statical conditions in a continuous material. This study area deals with many and diversified problems such as surface tension, Fluid Statics, flow in enclose bodies, or flow round bodies (solid or otherwise), flow stability, etc.

Fluid mechanics is widely used both in everyday activities and in the design of modern engineering systems from vacuum cleaners to supersonic aircraft. Therefore, it is important to develop a good understanding of the basic principles of Fluid Mechanics.

An ordinary house is, in some respects, an exhibition hall filled with applications of Fluid Mechanics. The piping systems for cold water, natural gas, and sewage for an individual house and the entire city are designed primarily on the basis of Fluid Mechanics. The same is also true for the piping and ducting network of heating and air-conditioning systems. A refrigerator involves tubes through which the refrigerant flows, a compressor that pressurizes the refrigerant, and two heat exchangers where the refrigerant absorbs and rejects heat. Fluid mechanics plays a major role in the design of all these components.

All components associated with the transportation of the fuel from the fuel tank to the cylinders, the fuel line, fuel pump, fuel injectors, or carburetors as well as the mixing of the fuel and the air in the cylinders and the purging of combustion gases in exhaust pipes are analyzed using fluid mechanics. Fluid mechanics is also used in the design of the heating and air-conditioning system, the hydraulic brakes, the power steering, automatic transmission, and lubrication systems, the cooling system of the engine block including the radiator and the water pump, and even the tires.

On a broader scale, fluid mechanics plays a major part in the design and analysis of aircraft, boats, submarines, rockets, jet engines, wind turbines, biomedical devices, the cooling of electronic components, and the transportation of water, crude oil, and natural gas. It is also considered in the design of buildings, bridges, and even billboards to make sure that the structures can withstand wind loading. Numerous natural phenomena such as the rain cycle, weather patterns, the rise of ground water to the top of trees, winds, ocean waves, and currents in large water bodies are also governed by the principles of Fluid Mechanics.

The students of the Grade in Industrial Chemical Engineering will apply the knowledge of this subject to others of third year, such as Physical Chemistry, Control of Chemical Processes and Experimentation in Chemical Engineering I. The students of the Grade in Engineering in Automotive, will later apply the knowledge acquired in the subject of Aerodynamics, third year.

The following course skills are developed:

- Knowledge of basic and technological subjects that enables students to learn new methods and theories, providing them with versatility to adapt to new situations,
- Capacity to solve problems using initiative, decision making, creativity, critical thinking, and to communicate and convey knowledge, abilities and skills in the field of Industrial Engineering, and the cross-curricular competencies
- Adopt a responsible and organised attitude towards work and a willingness to learn taking into account the challenge of the necessary continuous training,
- Apply scientific method strategies: analyse qualitatively and quantitatively the problem situation, propose hypotheses and solutions using industrial engineering models, speciality mechanics, and
- Work efficiently in a group, integrating skills and knowledge to make decisions in the field of industrial engineering.

The competencies and key knowledge that this course programme offers can be used in the following subjects of the grade in Industrial Engineering:
- Hydraulic machinery
- Hydraulic installations
- Pneumatic and hydraulic systems
CONTENIDOS TEÓRICO-PRÁCTICOS

In order to get the background knowledge, abilities and skills, the course content is divided into five blocks of learning units: Hydrostatics, Kinematics and Dynamics, Dimensional analysis, similitude and viscous flows, Flow Hydraulic machinery and Installations in pipes and open channels.

Theoretical content (chapters):

5. Pneumatic and hydraulic circuits.
7. Fluid forces on surfaces.
8. Fluid forces on submerged and floating bodies.
11. Fundamental equation of Fluid Dynamics.
12. Bernoulli equation.
15. Applications of the momentum equation.
16. Dimensional analysis and dynamical similitude.
17. Viscous flows.
18. Head losses in pipes.
24. Hydraulic pumps.

Practical content:

The students will perform 17 or 18 laboratory experiments.

1. Measurement of viscosity of a fluid
2. Rigid-body rotation of fluids
3. Fluid forces on surfaces
4. Verification of Bernoulli equation
5. Discharge in tanks
6. Study of Flow meters
7. Use of Weirs
8. Forces exerted by fluid jets
9. Study of primary (friction) head losses in pipes.
10. Study of secondary (minor) head losses in pipes.
11. Determination of cavitation in pipes.
12. Analysis of Pelton turbines
13. Analysis of centrifugal pumps
15. Time to empty a tank containing a liquid.
16. Water hammer
17. Wind tunnel
18. Pneumatics and hydraulic systems

Required materials (background, instructions, and lab report template) are posted on the course. Students will be assigned into groups/teams formed by three students, to perform the experiments. Group lab reports will be submitted after finish the lab.

Attendance to the laboratory sessions is compulsory.
The course is geared towards self-learning and uses participatory approaches as much as possible. A cooperative learning (AC, Aprendizaje cooperativo) methodology will be used, including lecture/presentation, group work, demonstrations, case studies, problem solving practical sessions (hands-on practice), small and large group exercises and role plays. The attendees roles and responsibilities will be change in the group/team.

The course objectives are:

- To introduce definitions, concepts, properties, principles, laws, observations and models of ideal and real fluids at rest and in motion.

- To provide basis for understanding fluid behavior at rest and in motion (laminar, turbulent) and for engineering design and control of fluid systems.

- To develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.

- To develop basis for correlating experimental data, designing tests, and using scale models of fluid flows.

- To learn nature of rotation, circulation, resistance (viscous, turbulent), boundary layers and separation with applications to drag and lift on objects

- To learn methods for computing head losses (friction and fitting losses) and flows in simple pipes and channels.

- To learn the fundamentals of pumps and hydraulic turbines and the way they operate.

- To identify and understand how the key elements work: compressor, cooler, separator, actuators, valves and accessories involved in pneumatic and hydraulic facilities.

- To solve engineering problems associated with pneumatic and hydraulic installations, designing a series of practical circuits.

- To contribute primarily to the students' knowledge of college-level mathematics and/or basic sciences and provide experimental experience.

The student will be able:

- To interpret, define and solve practical problems related with the nature of different types of fluids and their interactions on engineered and natural systems in order to develop technical projects.

- To identify, interpret and explain the terminology, the structural characteristics, key parts, operation and application fields of pumps and hydraulic turbines and manage that knowledge to choose the suitable machine for every installation, according to technical criteria.

- To prepare, present, defend, orally and in writing, and make reports on the subject working individually or in groups.

- To analyze, interpret and synthesize a Technical Project related to Fluid Mechanics.

The laboratory experiments, team project and homework assignments will be performed in groups in cooperative work.

A team project titled “Design and calculation of a pumping installation” will be performed in groups. The student group will have to identify and set all the parameters involved in the project according to the instructions provided by the teachers.

The student groups will co-evaluate the work made by the rest of the groups as for instance the team project.

The following individual or group assignments will be made along the course:

- Initial opinion survey on the subject
- Group/team meeting minutes
- 5/6 homework assignments
- Individual pop quizzes
- A mid-term exam
- Project Design sheet (planning sheet)
- First part of the Project Report
- Final Project Report
- Public presentation of the project

An evaluation will be expected at the end of the semester for students to give feedback on the course, and to outline what they have learned based on:

- Evaluation sheet
- Final Opinion survey

**TYPES OF TEACHING**

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- GCA: Applied fieldwork groups

**Evaluation methods**

- End-of-course evaluation

**Evaluation tools and percentages of final mark**

- Written test, open questions 30%
- Exercises, cases or problem sets 30%
- Teamwork assignments (problem solving, Project design) 30%
- Oral presentation of assigned tasks, Reading 10%

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

The course's assessment will be continuous, based on two mid-term examinations, weekly homework assignments, pop quizzes, and the realization of a laboratory report and a technical project based on the design of a pumping system.

Homework assignments: 20 % Team work
Mid term exam: 30 % Chapters: 1-17.
Laboratory Report: 15 % Team work
Technical Project: 35 % Team work

More specifically explained:

20%. Submission and assessment of homework assignments (deliverables or tasks assigned for the different topics). When students submit less than 80% of homework assignments, they will receive the grade Not submitted. The quality of the group assignment will also be taken into account.

30%. Students will take a mid term exam prior to carrying out the project.

15%. Report on laboratory practice, carried out in groups/teams. Completion of lab practice and corresponding report is compulsory in order to pass the subject. The quality of team work will also be taken into account.

35%. Completion of a Team Technical Project. The project evaluation will be function of the oral project presentation (presentation depending on the number of students enrolled in the academic course), the quality of the team work performed, as well as the individual evaluation tests and/or groups that are held during the last 5 weeks of the course.

- To pass the course, students are required to pass the two mid term exams.
- Students failing the mid-term exams will have the choice to pass a retake exam in May.
- Only the students fulfilling the requirements of the Official College Regulations (Article 43.1, Section c) will have the right to take a final ordinary exam.
- The students not attending to class or laboratory sessions or project classes or submitting less than 80% of the homework assignments will be Not Evaluated.

- There will be a final ordinary exam at the end of the course semester (in May) for those students who failed to pass the course by the previously explained evaluation method.

**SOME REMARKS:**

- Final exam in June's call: for the student who does not pass the subject by continuous assessment. 100% of the mark.
For students to justify the impossibility of continuous evaluation in the direction of the School:

- Final exam (call for May and June). 100% of the mark.

Article 43 of the Management Regulations for the teaching of undergraduate and first and second cycle, provides the proper reasons for non-participation in the continuous assessment (work reasons, victims of domestic violence, birth, adoption, foster care or daughters and children under three years in charge, care of dependent family member, students with disabilities equal to or greater than 33%, high-level athlete, artistic / cultural activities that involve travel or dedication, compatibility with other higher education, compatibility with political office, union, student representation, associations, NGOs, or other).

Once the student has taken part in a partial continuous assessment tests, it is assumed that you are following the continuous evaluation and get a final score calculated by weighting all tests. ONLY if they are not present at any of the tests, you get a rating of "not presented".

Students not performing the Laboratory experiments or the Project will receive the mark of NOT PRESENTED in the corresponding call.

Students who fail to pass the course according to the previously explained system of continuous evaluation will have the choice to take a final exam in the corresponding ordinary and extraordinary calls (June, July).

The students who decide not to follow the course according to the previously explained system of continuous evaluation will notify the waiver (renunciation) of continuous assessment to the teacher, and they will have the choice to take a final exam in the regular examination calls where all competencies and learning outcomes identified will be evaluated.

The waiver or renunciation of continuous evaluation may be applied during the teaching period of the subject. In any case, students which are not able to attend class on a regular basis because they are working or complying with the requirements of the management regulations for the first and second cycle courses, are asked to contact the teaching staff for an adapted program of development of competences and learning objectives of the subject.

Students who do not participate in the exams and/or in the project and/or in the laboratory practices, will receive the qualification of Not Presented in the corresponding call.

The final exam will be the same for all the groups.

EXTRAORDINARY EXAMINATION PERIOD: Guidelines and Opting Out

- The student failing the course will also have the choice to take a final extraordinary exam in June based on all the contents and problems studied all along the course.

MANDATORY MATERIALS

Most part of the following teaching material will be available on E-gela:

- Teacher resource notes
- Tables and diagrams
- Laboratory manual
- PowerPoint presentations (slides)
- Solved exams
- Problem statements and solutions
- Student guide, course project guide
- Appendices (minutes, forms, sheets)
- Homework assignments
**BIBLIOGRAFÍA**

### Basic bibliography

Most part of the bibliography listed for the subject and more can be found on the signature 532 in the Biblioteca de las Nieves library.


- **Mecánica de Fluidos Incompresibles y Turbomáquinas Hidráulicas.** Agüera Soriano, José. 5ª Edición. Edit. Ciencia. 2002.


### Detailed bibliography


### Journals

- Computers and Fluids
- El instalador
- Environmental Fluid Mechanics
- Experimental Thermal and Fluid Science
- Experiments in Fluids
- Flow Measurement and Instrumentation
- Fluid Dynamics Research
- Fluidos
- Geophysical and Astrophysical Fluid Dynamics
- Ingeniería Del Agua
- International Journal of Multiphase Flow
- International Journal of Heat and Fluid Flow
- International Journal of Heat and Mass Transfer
- Journal of Fluids Engineering
- Journal of Hydraulic Engineering
- Journal of Non-Newtonian Fluid Mechanics
- Montajes e instalaciones
- Physicochemical Hydrodynamics
- Physical review A. Statistical physics, plasmas, fluids, and related interdisciplinary topics
- Physical review E. Statistical physics, plasmas, fluids, and related interdisciplinary topics
- Physics of fluids
- Physics of fluids A. Fluid Dynamics
Web sites of interest

- Hydraulic Institute. www.pumps.org
- Pump-Flo Co. www.pump-flo.com/manulist.asp
- Animated software company, www.animatedsoftware.com
- Pumps and systems magazine: www.pump-zone.com,
- Enciclopedia básica sobre fluidos: http://hyperphysics.phy-astr.gsu.edu/ hbase/ fluid.html#flucon
- Principios de aeronáutica: http://wings.avkids.com/Libro/advanced.html
- Simulación de redes de distribución de fluidos: http://www.epa.gov/nrmrl/wswrd/dw/epanet.html
- UNESCO-IHE Institute for Water Education: http://www.unesco-ihe.org/

OBSERVATIONS

Tutorials: The students have a schedule of tutorials to deal with all issues related to the subject. Its use is encouraged to support the acquisition of the competences of the subject with the close support of the teacher, who is available to attend and help students. Outside the tutoring hours there will be no problem in attending students, whenever possible. It is recommended by appointment.
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**Outcomes / Objectives**

Production techniques, equipment and processes. Flexible manufacturing systems.

**Syllabus**

Description of production processes. Machine tools, plastic forming, casting, welding and others

Design of production processes

Facility layout

Independent demand inventory management

Sales and operations planning

MPS (Master Production Scheduling). MRP (Material Requirements Planning)

Capacity planning

Production scheduling – Operations Scheduling – JIT (Just in Time)

TOC – Theory of constraints. Project management: PERT, CPM
**Methodology**

**Teaching Method**

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</table>

**Assessment System**

**General criteria**
Production techniques, equipment and processes. Flexible manufacturing systems.

**Clarification regarding assessment**

**Bibliography**

**Basic Bibliography**
- Notes on production scheduling and control

**In-depth Bibliography**

**Websites**
Calculation and design of automobile structures

DESCRIPCIÓN Y CONTEXTUALIZACIÓN DE LA ASIGNATURA (INGLÉS)

The subject of calculation and design of automobile structures constitutes an introduction to the elasticity and strength of materials and their application in the field of automobile design.

The elasticity and strength of materials is the science that studies the behavior of the deformable solid. It can be contextualized within the subjects of Mechanics. When studying solids, two types are distinguished: rigid solid and deformable solid. In this subject, it will be considered that solids are deformable.

The theory of elasticity studies elastic bodies, formulating mathematically the relationship between external actions and the body’s response. The strength of materials, studies the most common elements of structures. These elements have a simple geometry, and allow the use of simplifying hypotheses that speed up the calculation. The results are not as accurate as those of the elasticity theory, but the error can be considered negligible.

COMPETENCIAS / RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA (INGLÉS)

Knowledge and use of the principles of strength of materials for the calculation and design of automobile structures.

CONTENIDOS TEORICO-PRACTICOS (INGLÉS)

1.- Introduction to the strength of materials.
2.- Tensile and compression.
3.- Stress and deformation state in tensile and compression.
4.- Shearing.
5.- Bending.
6.- Simple bending.
7.- Möhr’s theorems.
8.- Oblique or deviated bending.
9.- Compound bending.
10.- Hyperstatic bending.
11.- Continuous beams.
12.- Torsion.
13.- Torsion and bending.
14.- Expression of internal potential energy for different stress states.

METODOLOGIA (INGLÉS)

In the theoretical lectures, the theory will be explained and related examples will be solved.

In classroom practices, theoretical concepts can be explained and exercises to be developed proposed.
In class, the lecturer will propose some works, which can be problems, practices or exercises to work on theory. During the semester, there will be a midterm exam, which in case of being passed, will release material for the final exam. This exam, together with the possible problems collected in class, will account for 20% of the final grade.

A work will be proposed to be carried out by the students whose weight in the final grade will be 50%.

The final exam will have a weight of 30% in the final grade. In this exam, a minimum of 5 must be obtained to pass the subject.

**CONVOCATORIA ORDINARIA: ORIENTACIONES Y RENUNCIA (INGLÉS)**

The written tests to be developed are detailed below:

A midterm exam will be held in the middle of the semester. The approval of this exam releases contents. The final exams will be attended with pending contents.

The final mark of the exams will be the average of the two parts.

Who does not appear to the final exam, will obtain a grade of not presented.

The work has a value of 50% of the final grade. For the evaluation of the work, the following will be taken into account:

- The document: Quality, skills developed at work (minutes, tutorials, face-to-face hours).
- The presentation: Peer evaluation, teacher evaluation, attendance and participation.

**CONVOCATORIA EXTRAORDINARIA: ORIENTACIONES (INGLÉS)**

The same as in ordinary call.

**MATERIALES DE USO OBLIGATORIO (INGLÉS)**

Theory and problems explained during lectures.

**BIBLIOGRAFIA (INGLÉS)**

Joseba García Melero. Resistencia de Materiales. Editorial: UPV-EHU


Luis Ortiz Berrocal. Resistencia de Materiales. Editorial Mc Graw Hill

**OBSERVACIONES (CASTELLANO)**

In the event that a face-to-face assessment of the subject cannot be carried out, the pertinent changes will be made to carry out an on-line assessment by using the existing IT tools at the UPV/EHU. The characteristics of this on-line assessment will be published in the student guides (annex or action plan) and in eGela.
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<tr>
<td>Qualification</td>
<td>Degree in Industrial Electronic Engineering and Automatics</td>
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<tr>
<td>Type</td>
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<tr>
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<td>Systems and Automation Engineering</td>
</tr>
<tr>
<td>Language</td>
<td>Spanish</td>
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</table>

**Outcomes / Objectives**

Applications of industrial informatics and industrial communications

**Syllabus**

1. Introduction. Specific problems of control applications. The role of the computer in the control of different types of industrial systems.
2. Comparison centralised vs. distributed control.
3. Operating systems. Expansion of the knowledge of operational systems acquired in basic subjects. The role of the kernel. Kernel planning policy. Real-time operating systems.
4. Advanced C programming. Expansion of the programming concepts acquired in basic subjects: files, memory management, system calls, etc.
5. Concurrent programming techniques. Introduction to concurrent programming. Main concepts.
8. Description of the TCP/IP family of protocols.
Methodology

Teaching Method

<table>
<thead>
<tr>
<th>Face-to-Face Teaching Hours</th>
<th>Lectures</th>
<th>Seminars</th>
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<td>Classroom practice</td>
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<td>Field practice</td>
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<tr>
<td>Field practice</td>
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</tbody>
</table>

Assessment System

→ Written essay exam
→ Practical tasks (exercises, case studies or problems)
→ Group assignments
→ Presentation of assignments, reading...

Bibliography

Basic Bibliography
- STALLINGS, W. 2005. Sistemas Operativos. 5ª Ed. (Prentice-Hall)
- KERNIGHAN, BRIAN; RITCHIE, DENNIS. 1991. El Lenguaje de Programación C. (Prentice Hall)
- MARQUEZ F. M. 2004, Unix Programación avanzada, 3ª Ed, (Ra-Ma)
- CASTRO, M. y otros. 2007 Comunicaciones Industriales: Principios Básicos. Ed. UNED

In-depth Bibliography
- BURNS, A. y WELLINGS, A. 2003 Sistemas de tiempo real y Lenguajes de Programación, Ed. Addison-Wesley Iberoamericana, 3ª Ed.
- ASHENDEN, PETER J. 2008. The designer’s guide to VHDL.
- CASTRO, M. y otros 2007 Comunicaciones Industriales: Sistemas Distribuidos y Aplicaciones. Ed. UNED,

Magazines
- Revista Iberoamericana de Automática e Informática Industrial (http://riai.isa.upv.es/)
- IEEE Transactions on Industrial Informatics Computers in Industry Control Engineering

Websites
- www.ehu.es
- http://es.wikipedia.org/wiki/Modelo_OSI (Communications)
Embedded systems is a 4th year optional subject that pursues learning a set of modern tools. It is an eminently practical subject studying current microcontroller architecture and tools employed in developing microcontroller based systems nowadays. It follows the 3rd year starting subject about microcontrollers (Digital Electronic Systems) but focuses on 32-bit architectures, tools and stacks. It complements the subject Industrial Informatics.

As outcome of the development of the aforementioned competencies, the student will be able to solve basic implementation problems with microcontrollers including several peripherals and communications stacks where TCP/IP must be present. They will also have to introduce publicly the features of selected microcontrollers from several manufacturers.

CONTENIDOS TEÓRICO-PRÁCTICOS
32-bit microcontrollers
Architecture and peripherals
C programming language.
Development toolchain and libraries.
Concurrent process.
Communication protocols: CAN, LIN, TCP/IP
3rd party stacks (SD, LwIP, emWin)
Operating Systems
The following demonstrations will be run
IDE and code generation
JTAG debugging
Manufacturer libraries
Microcontroller’s features
GPIOs
Timers and Systick
Serial port
Graphic library
CAN communications
TCP/IP with LwIP
SD and filesystems
Operating systems

TEACHING METHODS
Master classes will use original datasheets, manuals, user’s guides and manufacturer’s reference designs as guiding thread to introduce concepts and develop competencies. It is pursued that students have direct contact with real life documentation and development tools. The demonstrations will be coordinated with the lectures so that the students can experience the concepts given in class by writing basic implementations of the learned functionality. Demonstrations are compulsory.
### TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
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Legend:
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- GCA: Applied fieldwork groups

### Evaluation methods

- End-of-course evaluation

### Evaluation tools and percentages of final mark

- Exercises, cases or problem sets 10%
- Individual assignments 90%

### ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

10% of the evaluation will be function of the achievements attained in the demonstrations. The final assessment work will be presented to the professor who will evaluate the specifications fulfillment (50%), the right use of the explained methodologies (25%), the grade of self-development (10%) and the exposition (5%).

In order to renounce this call the student only needs not to hand in the expected work.

If the student prefers to take a final exam, it will account for 100% of the note. To be able to opt for a final evaluation, the student should communicate that decision to the coordinator of the subject following the procedure issued by the UPV/EHU.

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The same rules apply in the second call.

### MANDATORY MATERIALS

32-bit microcontroller based development cards and tools (IDE, compiler, debugger).

### BIBLIOGRAFÍA

#### Basic bibliography
- STM32F769NI Datasheet
- 32F746GDISCOVERY Kit User's Manual
- STM32F7 HAL and Low - layer drivers User Manual
- Developing applications on STM32Cube with LwIP TCP/IP stack User Manual
- LwIP reference
- CAN Specifications
- Petit FAT File System Module

#### Detailed bibliography
- AVR308 Software LIN Slave
- "Embedded Software Know It All" Labrosse. Ed. Newness

#### Journals

#### Web sites of interest
- http://www.st.com
- www.semiconductors.bosch.de/pdf/can2spec.pdf
- http://elm-chan.org/fsw/ff/00index_p.html
- www.embedded.com

### OBSERVATIONS

In the evaluation tests, only non-programmable scientific calculators are allowed to be used. If the device is programmable the calculator will be retired and no additional device will be allowed, even if it fulfills the requirements. In case cheating is detected, the protocol about academic ethic issued by the University of the Basque Country will be followed.
COURSE GUIDE
2019/20

Faculty 163 - Faculty of Engineering - Vitoria-Gasteiz
Degree GIAUTO10 - Bachelor's Degree in Automotive Engineering
Cycle Not Applicable
Year Second year

COURSE
28132 - Finite Element Simulation and Analysis in Automotive Engineering
Credits, ECTS: 6

COURSE DESCRIPTION
This subject is the continuation of the one studied in the first four-month period "Calculation and design of automobile structures". In the subject of the first semester the basic theoretical knowledge of mechanical calculation will be explained and analytically applied.
In the present subject the students will work numerically, using a calculation software.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
Knowledge and use of the principles of the strength of materials for the simulation and analysis using the Finite Element Method in automotive.
The expected learning results are:
- Apply knowledge of strength of materials applied to automotive examples and the use of appropriate computer tools.
- Solve the problems of strength of materials by means of qualitative and quantitative analysis and to propose suitable solutions using the appropriate models.
- Prepare written and oral reports, expressing adequately theoretical knowledge, methods of resolution and results obtained.
- Work on projects applying the appropriate legislation or regulations.
- Analyze and evaluate the social and environmental impact by applying sustainability criteria.

COURSE CONTENTS, THEORETICAL & APPLIED
- Structural analysis. The matrix method.
- Linear and non-linear analysis, application examples.
- Finite elements in dynamics. Modal analysis, theory of vibrations.

TEACHING METHODS
Theoretical contents based on the resistance of materials and the method of finite elements will be explained in master classes.
In classroom practices, exercises will be carried out first analytically and then numerically using the specific software. And finally results obtained will be compared.
The first sessions of computer practices will be an overview of some tools of finite element calculation software.

TYPES OF TEACHING
<table>
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<tr>
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Evaluation methods
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Oral defence 10%
- Exercises, cases or problem sets 60%
- PRUEBA REALIZADA EN ORDENADOR 30%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

MANDATORY MATERIALS
- Teachers notes
BIBLIOGRAPHY

Basic bibliography
- Teachers notes

Detailed bibliography

Journals
- 

Web sites of interest

OBSERVATIONS
COURSE GUIDE 2021/22

Faculty 163 - Faculty of Engineering - Vitoria-Gasteiz
Degree GIEIAU10 - Bachelor's Degree in Industrial Electronics and Automation Engine
Cycle Not Applicable
Year Third year

COURSE

25996 - Digital Electronic Systems
Credits, ECTS: 6

COURSE DESCRIPTION

Digital Electronics Systems is a 3th year compulsory subject aiming at introducing the design of 8-bit microcontrollers systems their most common peripherals and protocols.

The referred devices are in the core of almost any electronic equipment manufactured today which portrays its practical utility.

It is convenient to have developed the competencies acquired in Digital Electronics and Informatics Fundamentals to successfully face this subject, which, in turn, is the starting point for the following subjects: Embedded Systems and Microelectronics.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The following competencies from the degree verified report will be developed:
C3 &#8211; Knowledge on basic and technologic topics, which will allow learning new methods and theories providing versatility to adapt themselves to new situations.
C4 &#8211; Capability to solve problems with initiative, decision-making, creativity, critic thinking and to convey and transmit knowledge and skills in engineering fields.
C6 &#8211; Capability to handle specifications, regulations and rules of mandatory compliance.
C10 &#8211; Capability to work in a multidisciplinary and multilingual environment
TEEOI3 &#8211; Knowledge of the foundation and applications of electronic circuits and microcontrollers.

As outcome of the development of the aforementioned competencies the following results are expected:
Mastering the use of tools and development environments for microcontroller based designs.
Capability to integrate information from professional sources in other languages
Capability to mount and solder a PCB interpreting its schematics

CONTENIDOS TEÓRICO-PRÁCTICOS

- 8051 based architecture
- Data and code memory
- Interrupts and integrated peripherals
- 8051 assembly language
- Asynchronous communications: RS-232 and RS-485
- Synchronous protocols: I2C and SPI
- I/O peripherals: LCDs, Key arrays
- Voltage supervisor and watchdogs
- Other architectures
- The following demonstrations will be carried out
  - IDE and code generation
  - Simulation/debugging
  - Functions and loops
  - GPIOs
  - Audio generation
  - Stepper motor
  - Serial port
  - Alphanumeric LCD
  - I2C LED driver
  - 4x4 key array read
  - IDEs for other architectures

TEACHING METHODS

Master classes introducing the required concepts to lead the learning process will be carried out. Active participation of the students will be fostered. Tests will have to be taken about the contents of the first 5 subjects.

Practical laboratory demonstrations in small groups will take place to implement different digital circuits. The demonstrations will be coordinated with the lectures so that the students can experience the concepts given in class. In some demonstrations, the student will be requested to submit a previous work. Attendance is compulsory.

The student should be able to handle different bibliographic resources and datasheets from manufacturers.
# Types of Teaching

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## Evaluation Methods

- Continuous evaluation
- End-of-course evaluation

### Evaluation Tools and Percentages of Final Mark

- Multiple choice test 40%
- Individual assignments 50%
- Oral presentation of assigned tasks, Reading 10%

## Ordinary Examination Period: Guidelines and Opting Out

Mounting a working microcontroller based PCB is compulsory to be evaluated.
The assessment work will be presented to the professor who will evaluate the specifications fulfilment (25%), the right use of the explained methodologies (10%), the grade of self-development (15 %) and the exposition (10 %). The assessment can be carried out from the 11th week.

Tests (40 %) will be carried out before starting with the microcontroller project. The mark obtained in this case will be the average of the tests marks.

In order to renounce this call the student only needs not to hand in the expected microcontroller work.

If the student prefers to take a final exam, it will account for 100 % of the note. To be able to opt for a final evaluation, the student should communicate that decision to the coordinator of the subject following the University regulations.

If any of the proposed activities cannot be performed for whatever reason, equivalent alternative activities will be scheduled and published

## Extraordinary Examination Period: Guidelines and Opting Out

First call rules apply for the second call.

## Mandatory Materials

- Microcontroller based PCB and related IDEs and compilers.

## Bibliografía

### Basic bibliography

- Microcontroladores MCS-51. Apuntes de clase de Ángel Mª Aledo Amorós
- Prácticas Básicas con microcontroladores. Apuntes de José Miguel Gil-García

### Detailed bibliography

- C and the 8051 Vol.I y II. Thomas W.Schultz

## Journals

In every chapter of [02] interesting URLs will be provided

- www.embedded.com
- www.8052.com

## Observations

In the evaluation tests, only non-programmable scientific calculators are allowed to be used. If the device is programmable, the calculator will be retired and no additional device will be allowed, even if it fulfills the requirements.

In case cheating is detected, the protocol about academic ethic issued by the University of the Basque Country will be followed.
Information on the course "Intelligent Control 6" (26007) is provided below:

**Course Guide:** 2020/21

- **Faculty:** 163 - Faculty of Engineering - Vitoria-Gasteiz
- **Cycle:** Not Applicable
- **Degree:** GIIGSI10 - Bachelor's Degree in Computer Engineering in Management and Information Systems
- **Year:** Fourth year

**Course Description:**

**Short Description:** This subject is aimed at designing and implementing computer-based control systems for different applications in engineering. Consequently, the students should learn: (1) the role of computers in modern control systems; (3) modeling discrete systems and signals; (4) analyze the stability of the systems; (5) design computer control-based systems and (6) discretize existing continuous systems.

**Subject Descriptors:**
- Control Theory and Feedback; Computer role in control systems; Signals and Systems; Discrete systems; Modeling; Dynamics and Stability; Cyber-Physical Systems (CPS)

**Previous Requirements:**

This subject is aimed at students from two different engineering degrees, namely (1) Industrial Electronics and Automatic Control and (2) Computer Management and Information Systems.

Some students may come from the degree at Computer Management and Information Systems, consequently they are not required to have previous knowledge in Control Theory. These students have a sound background in computers and programming algorithms which are basic tools for implementing complex computer control systems. On the contrary, students coming from the Industrial Electronics and Automatic Control degree are already familiar with the basic concepts of control theory but are less familiar with computers and programming tools. The combination of different kinds of students will produce multidisciplinary working groups which is a basic learning competence.

**Competencies/Learning Results for the Subject:**

Computer control will develop different competences and producing the following learning outcomes:

**Basic Competences:**
1. Acquire knowledge about basic and technological matters
2. Learn new methods and versatility to adapt to new situations
3. Solve problems with initiative and creativity, providing innovative solutions
4. Communicate and transmit knowledge in the Electronics & Computing domains
5. Working in a multilingual and multidomain environments.
6. Apply the scientific methodology strategies:
   a) Analyze problems and situations
   b) Make hypothesis
   c) Find solutions
7. Working both autonomously and in groups

**Learning Outcome:**
1. Learning the role of the computers in modern control systems
2. Learning the basics of dealing with signals
3. Understanding the basics of sampling and reconstruction of signals with computers
4. Ability of modeling discrete systems and signals
5. Capability for analyzing the stability of systems
6. Capability for designing simple computer-based systems
7. Techniques for discretizing continuous systems

**Course Contents, Theoretical & Applied:**

**Contents:**
1. Basic introduction to control
2. The role of the computer in control
3. Discrete signals:
   a) Mathematical representation of signals
   b) Signal sampling and reconstruction (Zero Order Holders, ZOH)
4. Discrete systems:
   a) Modelling of discrete systems (Difference equations / The Z transform / Block diagrams)
   b) Transient vs. steady state response analysis
c) Relationship between Laplace and Z transforms
d) Composing complex systems - Algebra of blocks
5. Stability analysis of discrete systems
6. Design of discrete control systems
   a) Discretisation of continuous controllers
   b) Digital Direct Control

NOTE:
These topics will be developed both in the classroom and in the laboratory.

TEACHING METHODS

CLASSROOM
1. Lectures will be used to explain the major concepts of this module.
2. Some collaborative activities will be included and the deliverables will be required. These deliverables will be used in the qualification of the students.

LABORATORY
1. Some exercises will be proposed to be solved by the students.
2. The students will have to create a short project where they must apply the concepts learnt during this module.

TYPES OF TEACHING

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Evaluation methods
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Individual assignments 10%
- Teamwork assignments (problem solving, Project design) 40%
- Oral presentation of assigned tasks, Reading 10%
- Portfolio 40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A. CONTINUOUS ASSESSMENT of the tasks:
1. Portfolio of the tasks proposed during the laboratory sessions (30%)
2. Reports of the Matlab exercises proposed in the lab.
3. Realization of a proposed miniproject related with the concepts learnt in the classroom (50%)
4. Presentation of the miniproject (10%)

NOTES FOR THE CONTINUOUS ASSESSMENT:
Students will be qualified as NON-PRESENTED when they do not completed the amount of the 55% of the total final assignments.
The deliverables associated to these tasks SHOULD be submitted by means of eGela.

B. ALTERNATIVE FINAL EXAM (100%)
The alternative final exam may include two parts, one written part with some questions and problems related to the syllabus of the module and another part in the laboratory where the students should solve some exercises with Matlab.

C. RENOUNCE PROCEDURE
Students will automatically renounce to the module when they do not present in time the 55 % of the proposed tasks of the module. In case these students want to pass the module, they should do the alternative final exam.

All students may renounce to present to the final exam by communicating it to the lecturer at least 15 days in advance.
EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXTRAORDINARY FINAL EXAM (100%)
The extraordinary final exam may include two parts, one written part with some questions and problems related to the syllabus of the module and another part in the laboratory where the students should solve some exercises with Matlab.

All students may renounce to present to the final exam by communicating it to the lecturer at least 15 days in advance.

MANDATORY MATERIALS
Matlab, Arduino

BIBLIOGRAPHY

Basic bibliography
3. eGela: [https://egela.ehu.es/]
4. Tutorial on Matlab and control: [http://ctms.engin.umich.edu/CTMS/]

Detailed bibliography

Journals
Automática (Elsevier)
International Journal of Control
Control System Magazine (IEEE)

Web sites of interest
1. eGela: [https://egela.ehu.es/]
2. Tutorial on Matlab and control: [http://ctms.engin.umich.edu/CTMS/]

OBSERVATIONS
COURSE DESCRIPTION

- The elasticity and strength of materials is the science that studies the behavior of the deformable solid. Mechanics provides tools to understand the movement of bodies, and is composed of very diverse fields. One way to classify these fields is the condition of body or particle. The Physics subject of the first year studies the mechanics of the particle, considering it a point in space that has mass. When studying solids, two types are distinguished: rigid solid and deformable solid. A rigid solid will be assumed when studying velocities and accelerations since it is not necessary to study the change of shape of the body. In the second year course Applied Mechanics the rigid body is studied. In this subject, however, it will be considered that the solids are deformable and in this case the movement has no significance. In fact, the mechanical systems studied will be in equilibrium.

The theory of elasticity studies elastic bodies, formulating mathematically the relationship between external actions and the body's response. The strength of materials, studies the most common elements of structures. These elements have a simple geometry, and allow the use of simplifying hypotheses that speed up the calculation. The results are not as accurate as those of the elasticity theory, but the error can be considered negligible.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The behavior of real (deformable) solids is introduced in this course. After an exposition of the fundamental concepts of the Theory of Elasticity, the program focuses on the analysis and design of prismatic piece-type structural elements, subjected to different section stresses. It starts with axial stress. Next, the stresses and deformations originated both in pure bending and in simple bending are studied, and their application is carried out for the resolution of isostatic structures.

- The subject provides knowledge that is at the base of the analysis and design methods of any Mechanical Engineering work.
- Specific Technology Module Competence, Mechanics:
- Knowledge and skills to apply the fundamentals of elasticity and resistance of materials to the behavior of real solids.
- Learning outcomes:
- Know, understand and apply the fundamentals of elasticity and resistance of materials to the behavior of real solids that enable the student for the subsequent application of advanced methods and theories in their professional development in areas of mechanical engineering and also provide them with a great versatility to adapt to new situations.
- Properly apply the strategies of scientific methodology to the problems posed by structural systems and the deformable solid: analyze the situation qualitatively and quantitatively, propose hypotheses and solutions to solve problems inherent to mechanical engineering.
- Express, using the appropriate means, the theoretical knowledge, resolution methods, results and aspects inherent to the problems posed by the equilibrium of the deformable solid and structural systems, using specific vocabulary and terminology.
- Work effectively in a group integrating skills and knowledge to formulate ideas, debate proposals and make decisions in the development of own work, the elasticity and resistance of materials.
- Carry out measurements, calculations, studies, reports and other similar work related to problematic situations that may arise in the field of elasticity and resistance of materials.

CONTENIDOS TEORICO-PRACTICOS

The elastic solid: stresses, deformations and compatibility equations.
- Tension and compression.
- Shear strength
- Flexure theory: pure, simple, compound, isostatic and hyperstatic.
- Torsion.
- Internal potential. Energy theorems

TEACHING METHODS

Fundamentals of elasticity and strength of materials will be explained and related examples will be solved in class. In class, the teacher will propose some works, which can be problems, practices or exercises to work on the theory. All these works will be evaluated and will represent 10% of the final grade.

During the semester, there will be a midterm exam, which, if passed, will release material for the final exam.

To pass the exams, whether partial or final, a minimum score of 3 out of 10 must be obtained in each section thereof. This will be indicated in detail in the statement of the exam.
Therefore, the final mark will be calculated as follows: 0.45 x partial exam mark + 0.45 final exam mark + 0.1 mark for individual works.

**TYPES OF TEACHING**

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
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<th>GA</th>
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<th>GCL</th>
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**Evaluation tools and percentages of final mark**

- End-of-course evaluation

**Ordinary Examination Period: Guidelines and Opting Out**

- Written test, open questions   60%
- Exercises, cases or problem sets   20%
- Individual assignments   20%

**Extraordinary Examination Period: Guidelines and Opting Out**

idem

**Mandatory Materials**

Teachers notes.

**Bibliografía**

**Basic bibliography**

Joseba García Melero. Resistencia de Materiales. Editorial: UPV-EHU

**Detailed bibliography**

Manuel Vazquez. Resistencia de Materiales. Editorial: Universidad Politécnica de Madrid

Luis Ortiz Berrocal. Resistencia de Materiales. Editorial Mc Graw Hill

Timoshenko. Resistencia de Materiales (2 tomos). Editorial: Espasa-Calpe

**Web sites of interest**

http://egela.ehu.eus

**Observations**
El ingeniero que diseña máquinas y estudia problemas mecánicos debe poseer una gran formación teórica y práctica. En concreto, debe estar capacitado para explicar la relación que existe entre la topología estructural, la geometría, las fuerzas y el movimiento en los mecanismos y en las máquinas, todo lo cual constituye el objeto de la Cinemática y Dinámica de Máquinas.

Durante el desarrollo de esta asignatura se pretende que el alumno adquiera destreza en la resolución de los problemas típicos de la Cinemática de Mecanismos, así como en el manejo de las técnicas de análisis de la Dinámica de Máquinas tanto del Sólido Rígido como del Sólido Deformable. Además, aparecen los primeros conceptos de diseño mecánico con el objeto de orientar al alumno en la síntesis de mecanismos que realicen determinadas funciones mecánicas. Una vez expuestas al alumno las técnicas básicas para el análisis de mecanismos, éstas se aplicarán al estudio de elementos de máquina concretos (levas y engranajes). Estos elementos, que transmiten fuerza y movimiento, forman parte de un sistema complejo: la máquina, protagonista de esta asignatura.

Esta asignatura se enmarca dentro de la línea curricular de Ingeniería Mecánica. Por tanto, Cinemática y Dinámica de Máquinas tiene su fundamento en la asignatura de 2º año de Grado Mecánica Aplicada, cuyo conocimiento y dominio es absolutamente primordial para seguir el temario de esta asignatura. Las competencias adquiridas en esta asignatura constituyen la base para las asignaturas Elasticidad y Resistencia de Materiales, Diseño de Máquinas, Estructuras y Construcciones Industriales y Tecnología Mecánica de tercer curso. A este respecto será necesario coordinar los contenidos y las prioridades con las asignaturas mencionadas dado que serán impartidas por el mismo departamento.

En Cinemática y Dinámica de Máquinas se desarrollan específicamente los fundamentos necesarios de la teoría de máquinas para el desarrollo profesional, y a su vez es básica para cursar la asignatura Diseño de Máquinas.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Análisis cinemático y dinámico de mecanismos y máquinas

CONTENIDOS TEÓRICO-PRÁCTICOS


TEACHING METHODS

Se imparten clases magistrales, que son complementadas con prácticas en el aula y con prácticas de Ordenador. El tipo de evaluación es mixta, en parte basada en entregables y actividades presenciales, y en parte basada en exámenes escritos.

TYPES OF TEACHING

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

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

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Valoración de la asignatura
Examen escrito a desarrollar 80%
Realización de prácticas (ejercicios, casos o problemas)20%

MÉTODO PARA RENUNCIAR A LA CONVOCATORIA DE EVALUACIÓN:
Dado que nuestra prueba final pesa el 80% de la calificación total de la asignatura: todos los alumnos, se acojan a la evaluación continuada o a la evaluación final, podrán renunciar a la convocatoria de evaluación sin más que no presentarse a la prueba final.
Adicionalmente, podrán presentar su renuncia mediante escrito al profesor responsable de la asignatura en el plazo indicado por la normativa de planificación docente y evaluación de la E/A. La normativa se encuentra en el siguiente enlace:

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT
En segunda convocatoria se realizará una única prueba o examen final (prueba escrita) en el que se contemplarán todos los contenidos desarrollados durante la asignatura.
Si el estudiante no se presenta al examen de la convocatoria EXTRAORDINARIA (junio/julio), obtendrá un "No presentado" independientemente de su participación en la realización de prácticas o en la exposición de trabajos.

MANDATORY MATERIALS
Apuntes y documentación proporcionada por el profesorado de la asignatura.

BIBLIOGRAFÍA

Basic bibliography
- ROQUE CALERO PÉREZ, JOSE ANTONIO CARTA GONZÁLEZ. Fundamentos de mecanismos y máquinas para ingenieros. Edit:Mc Graw Hill
- J. MARTELL PÉREZ, A. RODRÍGUEZ TORRES, PEDRO RAMÓN MOLINER. Elementos de máquinas. UNED (Universidad Nacional de Educación a Distancia)
- P.R. MOLINER. 134 problemas de teoría de máquinas y mecanismos. Cpda, etseib, upb
- BEDFORD. FOWLER. Dinámica, Mecánica para ingeniería. Edit: ADDISON WESLEY IBEROAMERICANA
- HAM, C.W.; ROGERS, W.L.,"Mecánica de Máquinas" Editorial: Del Castillo, S.A.
- KENNETH J. WALDRON/ GARY L. KINZEL "Kinematics, Dynamics, and Design of Machinery". 2004
- ROCA VILA, R. y LEÓN L., JUAN. "Vibraciones mecánicas". Edit: Limusa
- SINGERESU S. RAO "Mechanical Vibrations": Addison-Wesley Publishing Company.

Detailed bibliography

Journals

Web sites of interest
http://kmoddl.library.cornell.edu/model.php?
http://www.emc.uji.es

OBSERVATIONS
## COURSE GUIDE

<table>
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<tr>
<th>Faculty</th>
<th>163 - Faculty of Engineering - Vitoria-Gasteiz</th>
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### COURSE

26050 - Hydraulic Installations and Machines

| Credits, ECTS: | 6 |

### COURSE DESCRIPTION

La asignatura de Instalaciones y Máquinas Hidráulicas tiene como principal objetivo dotar al alumno del grado de ingeniería mecánica de los conocimientos básicos de los principios fundamentales de la ingeniería fluidomecánica aplicada a instalaciones industriales y a máquinas hidráulicas de gran relevancia en nuestra sociedad, haciendo hincapié en aquellas de producción de energía de última generación, necesario para el desempeño de las funciones prácticas de la ingeniería mecánica.

### COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Proyecto, funcionamiento en red y regulación de bombas hidráulicas. Proyecto de diferentes tipos de turbinas hidráulicas. Centrales hidroeléctricas

### CONTENIDOS TEÓRICO-PRÁCTICOS

Turbomáquinas hidráulicas: generalidades y principios fundamentales Se definen y clasifican las máquinas hidráulicas, así como las partes fundamentales de una turbomáquina, sus formas de representación y los triángulos de velocidades. Se incluye también la nomenclatura correspondiente a alturas, caudales, potencias, pérdidas y rendimientos, tanto en bombas como en turbinas. Se estudia también la aplicación del teorema fundamental de las turbomáquinas o de Euler a turbinas y a bombas, así como las distintas aplicaciones de las turbomáquinas hidráulicas.

Semejanza y análisis dimensional aplicado a las turbomáquinas Se analizan las semejanzas y analogías que deben existir entre dos turbomáquinas para poder transferir sus respectivos comportamientos. Mediante la utilización del teorema de Buckingham se determinan los parámetros adimensionales más importantes en turbomáquinas, analizando el teorema fundamental de Combes-Bertrand-Rateau. Se introduce el concepto de velocidad específica y se presentan ejemplos de turbomáquinas homólogas.

Turbobombas hidráulicas Se estudian los elementos, los tipos constructivos, las curvas características, la regulación y el funcionamiento de las turbobombas.

Máquinas de desplazamiento positivo Se analizan los distintos tipos de máquinas de desplazamiento positivo, sus elementos, su forma de funcionamiento y sus curvas características.

Instalaciones de bombeo Se estudia el cálculo y los detalles constructivos de las instalaciones de bombeo simples, las compuestas y las instalaciones de sobrepresión.

Ventiladores e instalaciones de ventilación Se analizan los elementos, los tipos constructivos, las curvas características, la regulación y el funcionamiento de los ventiladores, así como su aplicación a las instalaciones de ventilación.

Centrales hidroeléctricas Se describe la disposición de conjunto de centrales hidroeléctricas, se analizan los tipos de saltos a considerar, los tipos de centrales hidroeléctricas, así como sus elementos constitutivos fundamentales. Se estudia también el problema del cálculo del caudal de un río y los distintos tipos de curvas características y sistemas de regulación.

Turbinas hidráulicas. Se analizan los elementos, los tipos constructivos, las curvas características, la regulación y el funcionamiento de las turbinas hidráulicas.

Centrales eólicas. Se explica la teoría general de los aerogeneradores, la ley de Betz, y se describen los distintos tipos de aerogeneradores disponibles.

Redes de abastecimiento de agua y de saneamiento Se estudian la captación, regulación, conducción y distribución de agua, así como la recogida y distribución de aguas residuales.

### TEACHING METHODS

Se va a utilizar la estrategia del Aprendizaje Cooperativo (AC) como línea conductora del trabajo a realizar en la asignatura para desarrollar las competencias y objetivos de aprendizaje señalados, ya que es una metodología que permite implicar de una manera activa al alumno en su proceso de aprendizaje. La docencia se realizará de una manera colaborativa con los alumnos, de manera que éstos trabajaran en grupos de 3 alumnos formados por el profesor al principio del curso. Dentro de cada grupo se repartirán de una manera rotativa los distintos roles y responsabilidades. Las actividades a realizar son las siguientes:

- Encuesta inicial de la asignatura.
- Elaboración de un documento de grupo: reglas de funcionamiento del grupo y ¿qué se necesita para que un grupo funcione bien?
- Formación sobre qué es el trabajo en equipo y sobre el Aprendizaje Cooperativo.
- Clases expositivas y de resolución de problemas de tipo colaborativo. Cada grupo de alumnos deberá preparar la exposición de un tema del temario. En las clases expositivas habrá un cambio de actividad cada unos 20 minutos. Para
las clases expositivas se utilizarán diversas técnicas.

Lecturas individuales del material de los apuntes.

Puzzles, mediante los cuales los estudiantes se repartirán el trabajo de estudiar algunos temas teóricos de la asignatura, explicarse mutuamente estos temas y asegurarse de que todos los miembros del grupo los han aprendido.

7 tareas a realizar en grupo relacionadas con la resolución de problemas o cuestiones, cada una de las cuales lleva asociada la elaboración del acta correspondiente.

Un análisis de un caso (tarea 8) que implica la resolución de un problema numérico relacionado con la ética en la profesión de Ingeniería. A realizar en los mismos equipos.

2 pruebas individuales. Para dichos exámenes se empleará la técnica del examen de 2 etapas. Cada examen constará de dos partes, una primera individual, que supone el 75 % de la nota del examen, y una segunda parte realizada en los grupos de AC, que supone el 25 % restante. Pero, si la nota de esta segunda parte es menor que la de la primera, sólo interviene en la nota del examen la correspondiente a la primera parte (dividida por 0,75).

2 tutorías grupales con el profesor.

Evaluación entre compañeros, de manera que cada grupo evaluará algunos entregables preparados por otros grupos.

Prácticas de laboratorio, realizadas de forma cooperativa, que llevan asociadas la realización de un informe.

Un Proyecto a realizar en grupo, que será acordado entre el grupo de trabajo y el profesor.

Presentación oral del Proyecto, que será evaluada por el profesor y por el resto de los alumnos. La asistencia a las sesiones dedicadas a las presentaciones es obligatoria para todos los alumnos.

Autoevaluación y coevaluación individual sobre el funcionamiento de los miembros del grupo

Autoevaluación grupal sobre el funcionamiento del grupo.

Cuestionario individual de evaluación del proyecto. Examen individual para valorar el grado de consecución de los objetivos de aprendizaje relacionados con el proyecto.

### TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Types of teaching</th>
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- TA: Workshop
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- GCA: Applied fieldwork groups

### Evaluation methods

- End-of-course evaluation

### Evaluation tools and percentages of final mark

- Written test, open questions 25%
- Oral defence 20%
- Exercises, cases or problem sets 10%
- Individual assignments 10%
- Teamwork assignments (problem solving, Project design) 30%
- Oral presentation of assigned tasks, Reading 5%

### ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Para todo el alumnado, excepto para los que justifiquen la imposibilidad de realizarla en la dirección de la Escuela:

Evaluación continuada:
- Examen final en la convocatoria de Junio: para el alumno que no apruebe la asignatura mediante la evaluación continuada. 100 % de la nota.

Para el alumnado que justifique la imposibilidad de realizar la evaluación continuada en la dirección de la Escuela:
- Examen final (convocatoria de Mayo y Junio). 100 % de la nota.

El artículo 43 de la Normativa de gestión para las enseñanzas de grado y de primer y segundo ciclo, contempla las causas que justifican la no participación en la evaluación continuada (motivos laborales, víctimas de violencia de género, parto, adopción, acogimiento o hijas e hijos menores de tres años a su cargo, cuidado de familiar dependiente, alumnado con discapacidades igual o superior al 33%, deportista de alto nivel, actividades artístico/culturales que implican viajes o gran dedicación, compatibilización con otros estudios superiores, compatibilización con cargos políticos, sindicales, representación estudiantil, asociaciones, ONGs, u otros)

Una vez que el alumno ha tomado parte en una de las pruebas parciales de la evaluación continua, se asume que está siguiendo la evaluación continua y obtendrá una nota final calculada mediante la ponderación de todas las pruebas. SÓLO en el caso de que no se presente a ninguna de las pruebas, obtendrá la calificación de “No presentado”.

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

Vease apartado anterior, Convocatoria Ordinaria.

**MANDATORY MATERIALS**

- Apuntes del departamento
- Colección de problemas del departamento
- Guión de prácticas de laboratorio

**BIBLIOGRAFÍA**

**Basic bibliography**

**Detailed bibliography**

**Journals**
- Ingeniería del agua
- Tecnología del agua
- El instalador.
- Montajes e instalaciones.
- Fluidos.

**Web sites of interest**
- Hydraulic Institute. www.pumps.org
- Pump-Flo Co. www.pump-flo.com/manulist.asp
- Animated software company, www.animatedsoftware.com
- www.pump-zone.com

**OBSERVATIONS**
STUDENT GUIDE

SUBJECT: INDUSTRIAL CHEMISTRY

2020/2021

ASSOCIATED PROFESSOR JOSÉ MARÍA LOMAS

Vitoria, Gasteiz, September, 2, 2020
INDUSTRIAL CHEMISTRY

UPV/ EHU subject code: 26091

SHORT DESCRIPTION
Production and transformation processes of raw materials and resources into the main chemical products.

CONTEXT
This subject deals with the large-scale production of the main chemicals. The transformation of raw materials is considered from their origin, until transforming them into products, through the corresponding operations and processes.
This subject is transversal, insofar as it applies the knowledge of other fields of Physics and Chemistry, especially Thermodynamics, Q. Inorganic, Q. Organic and Q. Physics, in addition to the field of Engineering, such as Fluid Mechanics and Process Control.
In this sense, this subject collects elements of various subjects studied in the career, giving them a practical and functional aspect

OBJECTIVES
Know the most important chemical industrial production processes.
Apply the knowledge acquired in other subjects of the career in industrial reality, with a view to their professional practice.
Know the manufacturing methods of the main chemical products. Introduction to the economy of the sector.
Visit various manufacturing facilities, with process monitoring on site.
Relate energy and production aspects with their environmental impact.
Minimize the damaging effects of large-scale material production
Incorporate the criteria of the "Commitment to Progress" of many of the large chemical companies worldwide.
Promote the development of sustainable chemical manufacturing processes.
Relate production processes to pollution.
Prepare reports based on data from the bibliography and specialized magazines of the different industrial sectors.

SKILLS.

1. Be able to design and manage processes with material balances. TEQI1
2. Acquire knowledge to manage processes with energy balances. TEQI1
3. Understand the transformation techniques of the main raw materials. TEQI2
4. Be able to design procedures for the recovery of energy resources TEQI3
5. Learn the basics of the management of manufacturing processes for different products. TEQI2
6. Design and manage applied experimentation procedures and equipment and systems management, relating thermodynamic concepts in physical processes TEQI5
7. Develop capacities and acquire skills to design compound synthesis processes applying the TEQI7 safety standards.
8. Acquire the ability to apply the strategies of scientific methodology: propose hypotheses solutions to solve problems of I. Chemistry - TEQI8
9. Be able to adequately communicate knowledge, procedures and results in the field of chemical engineering, using the specific vocabulary and terminology TEQI9.
10. Work effectively in multidisciplinary environments integrating skills and knowledge to make decisions in the field of chemical engineering TEQI10
11. Know, understand and apply the legislation, specifications, regulations and mandatory standards TEQI11
12. Make measurements, calculations, studies and reports, during the completion of each of the practices carried out in the subject TEQI12.

**METHODOLOGY**

The presentation of the topics is done in master classes, with an audio-visual support of graphics, figures and additional documents. These plugins are available on the "eGela" website.

Theoretical teaching is complemented with assistance to companies in the Chemical Sector, included as Field Practices. From them, reports are prepared on various industrial sectors, including economic and social aspects.

The subject is divided into two balanced parts.

Each part has a theoretical exam, developing several questions and / or problems.

Type of exam: descriptive questions of processes, reactions and applications of the substances studied.

Optional: According to the development of the course, a team work on a sector of the chemical industry will be proposed, to be presented orally and as a team.

**TIMING AND TYPE OF TEACHING**

<table>
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<th>TYPE OF TEACHING</th>
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**M**- Master class

**S**- Workshop

**GCA**-On site visits

**NOTES**

For each of the theoretical topics taught, a Power Point document has been prepared, as well as other electronic documents that are uploaded on the Internet, through the eGela website, so that students can download it on their cell phone and / or personal computer.
In this subject it is intended that the student put into practice the knowledge acquired in the career, both in Chemistry and Engineering, for which it is considered that he must have passed most of the subjects that precede him in the curricular design.

**CONTENTS (TOPICS)**

**SUMMARY**

**EXPOUNDED SUMMARY**

**Topic 1- The Chemical Industry. Raw Materials**

**Topic 3- Alkaline Halide Industry and Sosa**

**Topic 4- Nitrogen Industry.**

**Topic 5- Industry derived from Phosphorus. Fertilizers**


Unit 8- Glass and ceramic industry.

Topic 10- Oil and its technology.

Topic 12- Petrochemical Industry
Starting materials, variety of products and fields of application. Basic petrochemical techniques (separation of species, structural transformation of hydrocarbons: decomposition of hydrocarbons ...). Obtaining synthesis gas, acetylene, olefins and aromatic compounds. Applications and derivative products.
Topic 13- Polymer Industry. Rubber and derivatives


Topic 14- Paper Industry


EVALUATION SYSTEM

On site practices: Individual works, related to Field Practices: 1 points / 10
To assess the work on the visit it is necessary to have attended. Each job is graded 0-10.

Team work: The work done and its presentation are valued: 1 point.

Taking two theoretical-practical exams, corresponding to two parts of the subject: 7 points / 10
It is necessary to obtain a minimum of 4 points / 10 in the mark of each exam to pass. In that case, the average of both is taken.

Class participation: 1 point / 10.
To consider class participation, it is required:

Regular attendance ≥ 85% classes. Maximum evaluation: 1 point / 10

Median attendance ≥ 60% classes. Maximum evaluation: 0.5 point / 10

Sporadic attendance <60% classes. This section is not evaluated

The Final Note corresponds to
Average mark of the partial or final exams: 70%
Note of field practical work: 20%
Class Participation Note: 10%
The evaluation criteria of the detailed previous aspects are published in eGela-Subject Conditions.

Conditions to pass the subject in the final exam in June or July

\[ 4 \leq \text{EXAM grade} \]

\[
\text{FINAL NOTE} = \left( \frac{\sum n \text{ PARTIAL EXAMS}}{n} \right) \times 0.70 + \left( \frac{\sum n \text{ WORKS}}{n} \right) \times 0.2 \text{ (n Field Practices carried out)} + \text{Class participation.}
\]

In case of not passing the subject, the works of the field practices are saved for the following course only once.

Remind that it is mandatory to bring a calculator to the exam.

**ADDITIONAL NOTE: BEHAVIOR IN WRITTEN EXAMS:**

Exit to the service and return during the tests is not allowed, unless they have a medical certificate.

The calculator can only be utilized if there are problems with operations.

Cell phones, smart watches or other devices with external data connection are prohibited. These devices should be set aside before the exam and out of reach. If one of these devices is found accessible to a student, even unused, the exam would be scored zero.

Students who, according to the teacher, copy or try to copy in an exam will have a zero and will fail the course.

**LIST OF COMPANIES / EVENTS VISITED SINCE 2006**

**ACERALIA**

Echévarri (Vizcaya)

Special steels and ferrous materials
LEOPOLDO SUGAR MILL
Miranda de Ebro (Burgos)
Sugar and ethyl alcohol.

BILORE SA.
Ordizia (Guipuzcoa)
Detergents

VALDERRIBAS CEMENTS
Olazagutía (Navarra)
Portland cement

DOW CHEMICAL IBÉRICA
Axpe (Vizcaya)
Polymers (Urethane, Propylene, etc)

BAYER ENAMELS
Vitoria
Pigments and enamels for metals and ceramics.

EXPOQUIMIA
Barcelona
International Fair of Chemical Industries

GUARDIAN. SA
Llodio (Alava)
Flat glass

GENERAL QUÍMICA SA (REPSOL)
Comunion (Alava)
Colorants, pigments, pesticides, etc.

ICOA SA
Villareal (Alava)
Polyurethane foams

INABONOS SA
Lodosa (Navarra)
Phosphate fertilizers

MICHELIN SA
Vitoria
Tires for Mining and Public works

MONTEFIBRE HISPANIA SA
Miranda (Burgos)
Acrylic fibers

OXINORTE SA
Baracaldo (Vizcaya)
Liquefied gases

PETRONOR SA
Muzquiz (Vizcaya)
Oil refining

INABONOS –TIMAC AGRO
Lodosa (Navarra)
Phosforic and fertilizers

SILCHEMICAL
Comunion, Álava
Silica powder

SMURFIT
Durango (Vizcaya)
Pulp and paper

SOLVAY SA
Torrelavega (Cantabria)
Sodium carbonate and chlorine

TUBOPLAST
Miñano (Álava)
Extruded plastic tubes.

UCAR ELECTRODOS SA
Olza (Navarra)
Manufacture of graphite electrodes

VIPLASTICA SA
Gamarra- Vitoria
Injection of plastic parts

EVALUATION

GENERALITIES

A Mixed Evaluation System is carried out, with elaborated exams and exercises.

To encourage student participation in class, their collaboration is evaluated. The course is divided into two parts. Each one has a theoretical exam, developing several questions and/or problems.

Exam type: descriptive questions. Of processes, reactions and applications of the substances studied.

Individual papers are prepared on the field practices carried out.

Optional: According to the development of the course, a team work on a sector of the chemical industry will be proposed, to be presented orally and by each one of the team.

BIBLIOGRAPHY

BASIC BIBLIOGRAPHY


ENLARGED BIBLIOGRAPHY

Stocchi, E. Industrial Chemistry. Ellis Horwood, Nueva York. 2010


Maria R. Gómez Antón y col. Química Inorgánica y orgánica de interés industrial. Madrid 2005

Magazines/webs


webs de interés

Federation of Chemical Industries of Spain http://www.feique.org/

Main companies in the sector. http://www.quimicainfo.com/
Description and Contextualization of the Subject

The subject "Manufacturing Processes in Automotive Technology" tries to introduce the student to the knowledge of the most relevant metal-mechanical manufacturing processes in the automotive sector and to familiarize him with the most significant elements and characteristics of each of them.

The main objectives are:

1.- To provide an overview and basic information related to the Metal-Mechanical Manufacturing Industry.

2.- To introduce the characteristics and capacities of the main processes of manufacture M-M (welding, molding, plastic forming and starting of material).

3.- To set the foundations and criteria to get to know how to choose the suitable manufacturing process for a specific type of piece.

4.- To know the basic procedures for the measurement and verification of parts.

Competences / Learning outcomes of the subject

Starting from the product design and the knowledge of the materials, the subject Processes of Manufacturing in Automotive Technology establishes the foundations of the knowledge and the application of the processes of conformation metal - mechanics in a logical sequence according to his location in the productive context. Hence the multidisciplinary nature of the subject, and the large number of interrelations with other fields or areas of knowledge.

This discipline is responsible for the identification and characterization of the various factors involved in the processes of mechanical transformation that a material experiences (mainly metals and their alloys), from being processed raw to being transformed into a finished product such as the parameterization of these factors and the establishment of limits for their control.

It is about developing the basic knowledge and skills for the selection, design and control of the processes of metal-mechanical manufacturing, from the production of unit parts to the production of large series, paying special attention to the criteria of flexibility and costs of the production and relationships with other fields of engineering knowledge.
Theoretical-practical contents

METROTECNIA

UNION OF METAL ELEMENTS. WELDING

MOLDING CONFORMATION

METAL PLASTIC CONFORMING

MACHINING

Methodology
The MA classes will serve to expose the theoretical foundations of the manufacturing processes and of those matters that are intimately linked to their development and control, trying to describe the multiple relationships existing with other disciplines and with the application of the knowledge that will be acquired in other Engineering specialties. Likewise, the conceptual bases for the realization of the practices of workshop and laboratory and for the resolution of practical exercises of medium complexity are established.

In the practices of workshop and laboratory will put into practice some of the knowledge acquired in the master classes, by means of the use of the software, instrumental and machinery available in each case.

The workshop and laboratory practices will be carried out in groups consisting of a maximum of 25 students, which will be organized in turn into teams of two, maximum three students (depending on the practice), who will develop the practice integrating skills and knowledge. In those cases where due to space, security or capacity of the available
equipment, the number of participants would have to be limited, the practice group will be subdivided into two subgroups of twelve or thirteen members each.

**Evaluation systems**

Tools and percentages of qualification:
- EXERCISES AND EXAMINATION DURING THE 20% COURSE
- WORK (PBL) 40%
- FINAL EXAM 40%

**Ordinary Call: Guidance and Waiver**

The evaluation of the ordinary call will be made according to the following criteria:

1) Evaluation of the workshop or laboratory practices: up to a maximum of 20% of the joint qualification.

2) Assessment of the mastery and / or knowledge of the contents of the master classes and the corresponding application exercises: up to a maximum of 40% of the joint qualification.

3) Assessment of learning based on PBL projects: up to a maximum of 20% of the joint qualification.

4) The previous evaluations will be complementary and their respective qualifications will add up to a maximum of 100% of the final joint qualification, having to approve both independently to pass the subject as a whole. The first practical class of the semester will be introductory and in it students will be informed about the details of the process of both assessments and about the minimums to be reached in each case.

5) The unjustified absence of two or more sessions of practices will mean the automatic loss of 20% of the maximum qualification attainable in the whole of the evaluation as a workshop or laboratory practice.

It will be possible to obtain 100% of the mark, by means of the theoretical - practical examination written in the case in which the student opts by the "System of Final Evaluation" for which he will have to communicate it in writing to the professor of the master classes of his group within nine weeks from the beginning of the course.

In the other cases the weighted sum of the qualifications obtained in the evaluation of the master contents and exercises of application and the evaluation of the practices of workshop and laboratory will be applied, having to fulfill, in any case, the condition expressed in the points 3 and 4.

**Extraordinary Call: Guidance and Waiver**

In the extraordinary call, there will be a single test or final exam (written test) in which all the contents developed during the course will be considered.
If the student does not attend the examination of the ORDINARY call or the EXTRAORDINARY call, he/she will obtain a “Not presented” regardless of his participation in the workshop or laboratory practices.

Materials of compulsory use

Documentation and information provided by the subject's faculty.

Bibliography

BASIC BIBLIOGRAPHY

The bibliography is specific to each topic, although there are two books that collect most of the topics consistently.

Mechanical Technology and Metrotechnics Coca Rebollero, Pedro and Rosique Jiménez, Juan
Editorial: Pyramid

Manufacture. Engineering and Technology Kalpakjian, Serope and Schmid, Steven R.
Publisher: Pearson Education

The claim of these texts is formative and not informative. Therefore, in the writing of each chapter, the process is analyzed, rather than described, for the reader, at each stage, to evaluate the influence of the parameters involved in it. Thus when the lamination is studied, for example, it goes deeper into the analysis of the thermal-mechanical process of the passage of the material between cylinders and deals very succinctly with the farragous (to be read) description of the lamination trains, since well looked at, cylinder more or less, does not change the essence of the process. The same can be said of casting technology, welding methods, etc.
28122- STUDY GUIDE- INTRODUCTION TO MECHANICS

Description and context of the subject:

Profile of the subject. In the education system promoted by the EEES, the centre of the educational process moves from the professor (teacher) to the student (learner), i.e., the driver in the learning process becomes the student. Furthermore, this learning process must not only be focused on whether the student acquires certain knowledge of the field of study, he/she should also be stimulated to develop general skills and personal qualities that allow him/her to adapt to a constantly changing society and, at the same time, continue learning in a continuous way, teach, communicate and apply the knowledge acquired to new situations that arise throughout his/her life.

In this respect, degree courses should prepare the student for entry into the labour market. This means that the emphasis is on general training for a professional future with the tools and knowledge required so that the student can learn and adapt to the changing labour market.

The subject Introduction to Mechanics plays its role within this general training, providing basic knowledge of mechanics to adapt to new technological developments. Furthermore, the procedures and the rigour of the scientific method will be given as the framework for carrying out the engineer’s work. It also provides the knowledge to undertake other subjects in the syllabus.

Location in the syllabus. Introduction to Mechanics will provide a solid basis to work on a series of subjects that the student will take at a later stage, e.g. Fluid Mechanics, Aerodynamics or Calculation and Design of automotive structures. As can be seen, Introduction to Mechanics is a core subject for Engineering studies.

Competences

The ability of the student to undertake a series of specific tasks that will be useful in the exercise of his/her work. The competences provide by the subject to an Engineering student are general and not limited to specific professional skills. Below we list the basic competences that the student needs to acquire after taking this subject, at three different levels.

General competences
1. Apply knowledge of physics, mathematics and chemistry to engineering-
2. Adapt to new techniques and tools of engineering.
3. Develop the ability to design and perform experiments, and to analyse the results.

Cross-cutting competences
1. Acquire the ability to learn in a quick and efficient manner.
2. Learn to work in groups and communicate the results obtained by the group in a coherent and summary form.
3. Acquire autonomy and independence when taking on the work assigned.

Specific competences
1. Interpret the major theories of physics to describe natural processes.
2. Identify situations that are different in terms of physics but that show analogies, to use already-known solutions for new problems.
3. Solve problems and analyse solutions to them in groups or on an individual basis, and clearly evaluate their orders of magnitude.
4. Obtain, describe, analyse and evaluate critically, in groups or individually, experimental data obtained in the laboratory.
5. Estimate the uncertainty of any medium and of the results of physical calculations and process experimental data to obtain quantitative relations of cause-effect within the scope of the subject.
COURSE DESCRIPTION

The subject of Basic Programming introduces students to the field of software development. This subject is the first step in the training of students in the development of programs in the degree course.

The main goals of this module re:
1. Learn the application development methodology: specification, algorithm design following a top-down approach and implementation.
2. Learn to document the solution following the methodology.
3. Be able to deal with problems that require working with lists and data sequences.
4. Be able to understand and use the main programming structures:
   a. Control structures: sequential, conditional and iterative structures.
   b. Functions and procedures.
   c. Data structures.
5. Implement the structures in a particular language: Java.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The competences to be acquired in the subject are:

- Ability to analyse and explain the behaviour of programs that contain: instructions, I/O operations, iteration, sub-programs.
- Ability to divide a problem into logical parts that can be solved (programmed) independently.
- Ability to design simple algorithms to solve problems, implement them, test them and fine-tune them. Ability to write code in accordance with rules of good practice.
- Knowledge, design and efficient use of the most suitable types and structures of data for problem-solving.
- Knowledge of basic algorithmic procedures in IT technologies for design solutions to problems, analysing the suitability and complexity of the algorithms proposed.

CONTENIDOS TEÓRICO-PRÁCTICOS

1. Introduction
   This chapter introduces programming, focusing on the methodology that entails several steps (specification, algorithm design, implementation and test). It highlights the importance of the algorithm design.

2. Elementary concepts for programming
   Throughout this chapter, the student will learn the basics of algorithm design and programming.

3. Functions and procedures
   In this chapter the student will learn to design and implement subprograms.

4. Control structures and algorithm templates
   This chapter covers the conditional and iterative structures. In addition, the main algorithm templates will be presented.

5. Data structures
   This chapter presents the mechanisms to define complex data structures and lists.

TEACHING METHODS

During lectures, explanations of concepts will be combined with the performance of exercises.
In the laboratory, a series of (previously-distributed) exercises will be worked on. The sessions require prior preparation and the presentation of a report using the problem-solving methodology given. A project will also be created, in which the student will put the concepts worked on in the subject into practice.
**TYPES OF TEACHING**

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
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</table>

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

**Evaluation tools and percentages of final mark**

- End-of-course evaluation

- Written test, open questions 55%
- Exercises, cases or problem sets 45%

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

Assessment in the ORDINARY call will be done under continuous assessment or final assessment. By defect, all students will do continuous assessment unless they withdraw from it.

* FINAL ASSESSMENT
The student may withdraw from continuous assessment to do final assessment (final exam). This withdrawal will be presented in writing to the professor responsible for the subject in the periods established in Article 8 of the Rules on Assessment of Students. Exceptional cases will not be accepted, nor can students withdraw from continuous assessment after the stated dates.

* CONTINUOUS ASSESSMENT
The final grade of the subject is calculated on the basis of the exam marks (55%), laboratory work (35%) and individual practical work (15%).

GRADING IN MINUTES:

Students who have not withdrawn from continuous assessment will be considered as presented for the ORDINARY call.

To pass the subject, the student must take all the exams and obtain a minimum final grade of 5 out of 10. The student must also score at least 3.5 out of 10 in the grade corresponding to the exams in which the practical and laboratory work is included. Otherwise, the grade obtained will the average marks of the exams.

* WITHDRAWAL FROM THE EXAM
A student who, having opted for final assessment, does not present him/herself for the ORDINARY call will be graded as "NOT PRESENTED". A student who takes continuous assessment may withdraw from the call as per stipulated in Article 12 of the Rules on Student Assessment.

* CASES OF COPYING
Article 11 of the current rules on student assessment will be applied.

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

Assessment in the EXTRAORDINARY call will consist of three parts:

In the extraordinary call, the students may recover the parts corresponding to practical work and laboratory work by answering some specific questionnaires.

If they have passes all these parts, they may maintain the grade obtained in the ordinary call.

Students who have withdrawn from continuous assessment will have a single final exam in which the aspects worked on in class, the laboratories and practical sessions will be assessed.

To withdraw from this exam, it is sufficient not to appear on the day.
MANDATORY MATERIALS

Course material in egela

BIBLIOGRAFIA

Basic bibliography

"Una Introducción a la programación. Un enfoque algorítmico". J.J.Garcia, F.J. Montoya, J.L Fernandez, M.J. Majado
Thomson Ed. 2005

"Oinarriko Programazioa. Ariketa-bilduma" Díaz de Ilarraza A., Sarasola K.

Detailed bibliography

"La práctica de la programación". B.W. Kernighan, R. Pike.


Journals

Web sites of interest

es.wikibooks.org/wiki/Fundamentos_de_programación

OBSERVATIONS
<table>
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<tr>
<th>Centre</th>
<th>University College of Engineering of Vitoria-Gasteiz</th>
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**Outcomes / Objectives**

The subject comprises the following: segmented processors, the basic building blocks of today’s processors; the functional units that provide support for multimedia applications; minimum essential notions for software and hardware support for implicit and explicit parallelism; cache memory as an integral part of a computer’s memory hierarchy. Students analyse the efficiency with which compilers generate code, and write small parallel programs.

**Syllabus**

Cache memory. Analyses the most important parameters of cache memory. Studies on real programs the importance of taking cache memory into account when programming. Analyses some compiler optimisations.

Linear Segmented Processor. Students build a linear segmented processor. Some compiler optimisations that improve processor performance.

SIMD instructions. Analyses low level SIMD instructions: operations with small vectors supported by the functional units of conventional processors. Practical examples of programs for PC type processors.

Introduction to Parallelism. Different types of parallelism, as well as their hardware and software support. Analyses programs with parallelism extracted by the compiler and directly specified by the programmer.
Methodology

Teaching Method

Face-to-Face Teaching Hours

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
<th>Computer sessions</th>
<th>Clinical practice</th>
<th>Workshops</th>
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Student Hours of Non Face-To-Face Activities

<table>
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<tr>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
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Assessment System

General criteria

Oral exam.
Practical activities (exercises, case studies or problems).
Group assignments.
Presentation of assignments, reading...

Clarification regarding assessment

ORAL EXAM: 20
PRACTICAL ACTIVITIES (EXERCISES, CASE STUDIES OR PROBLEMS): 30
GROUP ASSIGNMENTS: 30
PRESENTATION OF ASSIGNMENTS: 20

Bibliography

Basic Bibliography

ARQUITECTURA DE COMPUTADORES. UN ENFOQUE CUANTITATIVO.

COMPUTER ARCHITECTURE: A QUANTITATIVE APPROACH.

ORGANIZACION DE COMPUTADORES.

ORGANIZACION Y ARQUITECTURA DE COMPUTADORES.

In-depth Bibliography

Websites

-
COURSE GUIDE 2021/22

Faculty: 163 - Faculty of Engineering - Vitoria-Gasteiz
Degree: GIIGSI10 - Bachelor's Degree in Computer Engineering in Management and In
Cycle: Not Applicable
Year: Second year

COURSE
26021 - Languages, Computing & Smart Systems
Credits, ECTS: 6

COURSE DESCRIPTION

The content of this subject course belongs to a classical branch of theoretical computer science that predates modern computers. It sets out from the theory of automata and formal languages, applied directly to the definition of programming languages and the construction of compilers.

The formalisms dealt with allow the computer/computing concept to be abstracted to analyse the computability, complexity and processability of the algorithms used in current areas like optimising algorithms and cryptography.

Algebra of sets and the formal specification/description of languages is used, so it is useful to have completed the subject course in Programming Methodology in the first year of this degree, and specification in particular.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

- Identifying and solving problems that can be approached using restricted computational (automata) or alternative (smart systems) models.
- Using regular expressions and grammars to define formal languages.
- Using pattern recognition and processing software.
- Understanding the existence of intrinsic limits to computational processes and their consequences.
- Knowing and using different programming paradigms and alternative computing models.
- Working on and analysing problems and their computational solutions by making use of verbal, mathematical and graphic language.

CONTENIDOS TEÓRICO-PRÁCTICOS


TEACHING METHODS

Lectures (M) outline the different theoretical bases of the subject course, introducing algorithms in the form of exercises worked on in class. Further exercises are set for working on in pairs in the laboratories (PL), which are checked using automata simulators (JFLAP).

TYPES OF TEACHING

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Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions: 75%
- Exercises, cases or problem sets: 25%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

At least 5 points out of 10 must be scored to pass the subject course.
There will be three partial examinations accounting for 75% of the course mark. For the ordinary session there will be an
optional catch-up session for each of the three blocks to boost marks.
Laboratory work will be worth 25% of the mark, with individual testing after completion.
If continuous assessment is waived there will be a final examination worth 100% of the mark. The lecturer must be
informed of this waiver by the 9th week, in accordance with current regulations.
If the final is not attended it will be considered not sat.
If the course cannot be assessed face-to-face, the relevant changes will be made to carry it out online by using the IT
tools available at the UPV/EHU. The particulars of this online assessment will be made public.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

For the ordinary session there will be a final examination worth 100% of the mark. No mark is carried over from previous
assessments.

MANDATORY MATERIALS

Course notes and JFLAP simulator.

BIBLIOGRAFIA

Basic bibliography
V. MATHIVET, "Inteligencia Artificial para desarrolladores. Conceptos e implementación en Java", ENI Ediciones, 2017
J.E. HOPCROFT, R. MOTWANI, J.D. ULLMAN; "Teoría de Autómatas, Lenguajes y Computación" 3ª ed. Pearson
educación, 2007
S.H. RODGER, T.W. FINLEY; "JFLAP: An Interactive Formal Languages and Automata Package". Jones and Bartlett,
2006

Detailed bibliography

Journals

Web sites of interest
Java Computability Tool kit (JCT): http://humboldt.sunyit.edu/jct/
Visual and interactive tools (JFLAP): http://www.jflap.org/
Implementación de algoritmos de IA en Java: https://github.com/aima-java/aima-java

OBSERVATIONS
**COURSE GUIDE**

<table>
<thead>
<tr>
<th>Faculty</th>
<th>163 - Faculty of Engineering - Vitoria-Gasteiz</th>
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<tr>
<td>Degree</td>
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<tr>
<td>26023 - Operations Research</td>
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**COURSE DESCRIPTION**

“Operational Research” is an area of study that is originated during the Second World War, basically, it consists of applying the scientific method (making use of mathematic models, statistics and algorithms) in order to model and solve complex problems.

Most of the situations try to find an optimal use of the resources, which are subjected to a series of limiting conditions. The applications are wide and include the manufacturing improvement, business management and programming.

In its current state “Operational Research” covers a wide range of topics such as linear and nonlinear programming, simulation, graph theory and so on. The aim of this academic subject is having a first approach to the problems, tools and strategies considered here, as well as acquire basic/medium competences for employing these techniques in productive contexts.

The subject is part of the module devoted to "basic training", in particular, inside the unit of "mathematics", and gives answer to the competence CM01 ("being able to solve mathematic problems in Engineering. Capability to use efficiently Algebra, Calculus, Numeric Methods, Statistics and Optimization"). It complements the rest of subjects on mathematics that are seen during the studies.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

During the course, some deterministic methods concerning "Operational Research" aimed at solving lineal models will be revised. As for the competences that students will acquire, the following ones can be stressed:

- **C1.** Application of the scientific method in problems related with the control of organizations or systems so as to improve the solutions.
- **C2.** Understanding of real problems and ability to model them mathematically under different circumstances.
- **C3.** Employ specific mathematic tools.
- **C4.** Analyzing how changes in inputs might affect to the outputs of a model (sensibility).

**CONTENIDOS TEÓRICO-PRÁCTICOS**

- Chapter 1: Introduction.
- Definition of the subject, stages of implantation and critical assessment of the method.
- Chapter 2: Linear programming, basics.
- Definition of a lineal program and graphic solution.
- Chapter 3: Simplex method.
- Description, uses, variations and computational issues.
- Chapter 4: Duality.
- Dual formulation and properties.
- Chapter 5: Analysis of sensibility.
- Study of the changes in the solutions due to changes in the initial conditions.
- Chapter 6: Integer linear programming.
- Problem solving when the variables have to take only integer values. Specific algorithms.
- Chapter 7: Model of transportation.
- Application to the transportation problem.

**TEACHING METHODS**

During part of the sessions, the lecturer will explain the concepts related with each chapter and propose points of discussion with students, therefore, participative sessions will be greatly encouraged. Complementarily, some sessions will be dedicated to practical exercises. The students will also work in groups developing a personal case study that will be part of the evaluation.

All teaching material will be available in the virtual classroom and students will have at their disposal a wide range of virtual tools for studying and communicating with their colleagues and with the lecturer.

**NOTE:** In case that the lessons and/or exams could not be done face-to-face, alternative options will be set up in order to replace them by on-line activities by means of the tools provided by the university. The characteristics of the on-line evaluation will be published in the virtual classroom and in an amendment of the academic guide.
### Types of Teaching

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
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### Evaluation tools and percentages of final mark

- End-of-course evaluation

#### Evaluation methods

- Written test, open questions 60%
- Teamwork assignments (problem solving, Project design) 20%
- Actividades en el aula virtual 20%

#### Ordinary Examination Period: Guidelines and Opting Out

- Written test, open questions 60%
- Teamwork assignments (problem solving, Project design) 20%
- Actividades en el aula virtual 20%

#### Extraordinary Examination Period: Guidelines and Opting Out

By means of a written exam (100% of the mark). Previous work done along the semester will not be considered in the extraordinary call.

NOTE: In case that the lessons and/or exams could not be done face-to-face, alternative options will be set up in order to replace them by on-line activities by means of the tools provided by the university. The characteristics of the on-line evaluation will be published in the virtual classroom and in an amendment of the academic guide.

### Mandatory Materials

Materials in the virtual classroom.
**BIBLIOGRAFÍA**

**Basic bibliography**

"Operations research : an introduction"
Taha, Hamdy A.
Ed. Prentice-Hall

"Linear programming : foundations and extensions"
Robert J Vanderbei
Ed. Springer

**Detailed bibliography**

"Elementary linear programming with applications"
Bernard Kolman, Robert E Beck, Robert Edward Beck
San Diego Academic Press

**Journals**

https://link-springer-com.ehu.idm.oclc.org/journal/41274
https://www-sciencedirect-com.ehu.idm.oclc.org/journal/european-journal-of-operational-research

**Web sites of interest**

https://www.ehu.eus/es/web/dma

**OBSERVATIONS**
COURSE GUIDE 2021/22

Faculty 163 - Faculty of Engineering - Vitoria-Gasteiz  Cycle Not Applicable
Degree GIIGSI10 - Bachelor's Degree in Computer Engineering in Management and In  Year Third year

COURSE

26025 - Information System Security Management Systems  Credits, ECTS: 6

COURSE DESCRIPTION

This subject course combines two essential aspects of the degree: Management Systems and Information Systems. Situated within business organisations, it identifies the importance of the three pillars of cybersecurity for business continuity: Confidentiality, Integrity and Availability. It works with the precise vocabulary of the security context to make possible a diagnosis tailored to each organisation’s needs to open the way to constant improvement by means of Management Systems through the gradual reduction of vulnerabilities and the establishment of safeguards, without forgetting staff training and awareness-raising.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

- Being familiar with the main concepts necessary for risk analysis and management in information systems
- Being familiar with the features of security management standards in information systems
- Designing, planning and implementing adequate IT security policies and measures in terms of effectiveness and cost
- Integrating technical IT security know-how into ethical, legal and organisational planning
- Being able to perform technical tasks that make up an information system security management system, such as proper control of passwords, backup copies, encryption, use of anti-malware, auditing and physical security.
- Designing training plans for people connected with information systems
- Efficient group working to coordinate technical and organisational tasks
- Being familiar with the legal framework governing professional practice (Data Protection Act, Information Society Services Act and Digital Signature Act)

CONTENIDOS TEÓRICO-PRÁCTICOS

- Information System Security Risk Analysis and Management
- Backing up information and security copies
- Controlling access to information resources: identification and authentication. The digital signature
- Malware: security risks and measures
- The human factor
- Encrypting information: contexts of use and basic techniques
- Software protection
- Planning, organisation and administration of IT security, audits: technical and standard
- Legal, ethical and organisational aspects: Data Protection Act, Information Society Services Act and Digital Signature Act

TEACHING METHODS

Lectures (M) introduce concepts in presentations that are published on the eGela platform, allowing discussion of the main pillars of Security Management in the context of organisations and its importance in Information Systems. Practical work (GL) makes it possible to approach typical security issues through individual and group reflection. This can take different forms and includes the study of scientific articles, press articles, pair work exercises, group protective software selection processes and active participation in conferences on security and personal data protection, among others. The work is submitted as reports and public presentations and is assessed by the lecturer and by colleagues.

TYPES OF TEACHING

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<thead>
<tr>
<th>Types of teaching</th>
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Evaluation methods
- End-of-course evaluation

Evaluation tools and percentages of final mark
Obligatory tasks of different kinds will be set during the course, both individually and as a group. Deliverables will consist of reports and presentations to give in class, assessed by the lecturer and by colleagues according to predetermined criteria.

For continuous assessment practical work, reports and presentations will be worth 40% of the final mark. There will be a final written examination worth 60% of the final mark, in which a minimum of 3.5 out of 10 must be scored to pass the course.

If continuous assessment is waived there will be a final examination worth 100% of the mark. The lecturer must be informed of this waiver by the 9th week, in accordance with current regulations.

If the course cannot be assessed face-to-face, the relevant changes will be made to carry it out online by using the IT tools available at the UPV/EHU. The particulars of this online assessment will be made public.

Assessment of the extraordinary session will be by a single written examination covering the topics seen in the lectures and laboratory work, updating cases from one year to the next. Relevant material produced by students will be made available for reference to the rest of the eGela platform.

Class notes, classroom and laboratory teaching support material. Data Protection Act, Information Society Services Act and Digital Signature Act.

Basic bibliography
Álvaro Gómez Vieites, "Enciclopedia de la Seguridad Informática", Ra-Ma 2011 (2ª edición actualizada)

Jesús Costas Santos, "Seguridad y Alta Disponibilidad", Ra-Ma 2011.

Detailed bibliography
ACISSI, "Seguridad Informática &#8211; Ethical Hacking. Conocer el ataque para una mejor defensa", 2ª ed,ENI ediciones, 2013


Auditoría + Seguridad informática
IEEE Security & Privacy

Web sites of interest
https://www.incibe.es/
http://www.criptored.upm.es/
http://www.intypedia.com/
http://www.rediris.es/
http://www.avpd.euskadi.eus
http://www.agpd.es/
## COURSE GUIDE 2021/22

<table>
<thead>
<tr>
<th>Faculty</th>
<th>163 - Faculty of Engineering - Vitoria-Gasteiz</th>
<th>Cycle</th>
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<tr>
<td>Degree</td>
<td>GIIGSI10 - Bachelor's Degree in Computer Engineering in Management and In</td>
<td>Year</td>
<td>Fourth year</td>
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### COURSE

<table>
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<tr>
<th>Code</th>
<th>Description</th>
<th>Credits, ECTS:</th>
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<tbody>
<tr>
<td>26036</td>
<td>Development of Graphic Systems</td>
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### COURSE DESCRIPTION

Real-time graphic applications, and especially video games, are one of the most complex fields of software, as they require knowledge in various areas of knowledge such as graphic programming, physics, sound, artificial intelligence, etc.

This subject is an introduction to the demanding world of video game that focuses on graphic programming. In addition to learning the specific concepts and techniques of programming, students will put into practice in a group project more general concepts and techniques of programming and software engineering acquired in the subjects of Basic Programming, Modular Programming and Object Orientation, Data Structures and Algorithms and Engineering of the Software.

The course is structured around two projects in a larger group than those carried out in previous subjects, in which students will work the different stages of a software project. Due to the entity of these projects, students will face the need to coordinate among several programmers using tools for collaborative development, this skill is essential for the world of work. During project work students will be supervised by the teacher but will make design decisions autonomously, learning from both successes and mistakes. Although the subject does not teach everything necessary to enter directly into a professional video game studio, it provides a first approach to the programming of graphic applications, which is a work area with many outputs in the labor market: video game programming, simulation, image/video processing, architecture, etc.

### COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Students taking this course will acquire the specific skills listed then. These have been particularized for the subject from the competences of the module of which it is part.

- **G001** - Ability to develop graphical applications in real time.
- **G005** - Ability to conceive, develop and maintain systems, services and applications using software engineering methods as an instrument for the quality assurance.
- **G009** - Ability to solve problems with initiative, decision-making, autonomy and creativity. Ability to communicate and transmit knowledge, skills and skills in the profession of Computer Engineer.
- **G012** - Knowledge and application of basic elements of human resources management, organization and project planning.
- **CB5** - Students have developed the necessary learning skills to undertake further studies with a high degree of autonomy.

### CONTENIDOS TEÓRICO-PRÁCTICOS

The theoretical contents of the subject are structured according to the following agenda:

1. Introduction to graphic systems.
   1.1. Definitions.
   1.2. Basic concepts: application, graphic engine, API, hardware.
   1.3. Basic structure of graphic applications.
2. Graphical programming interfaces.
   2.1. Graphic programming in two dimensions.
   2.1.1. Primitive drawing.
   2.1.2. Projection matrices for two-dimensional drawing.
   2.1.3. Textures.
   2.2. Graphic programming in three dimensions.
   2.2.1. Projection matrices for three-dimensional drawing.
   2.2.2. Lighting.
3. Applications with graphical interface.
   3.1. Introduction.
   3.2. Graphic engines.
   3.3. Control and animation.
   3.4. Introduction to collisions and physics.

### TEACHING METHODS
### TYPES OF TEACHING

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

### Evaluation tools and percentages of final mark
- Multiple choice test 20%
- Teamwork assignments (problem solving, Project design) 80%

### ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the exceptional call the student will perform a written exam in which 100% of the student's note will be valued. This test will consist of test questions and practical exercises to solve.

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

All necessary materials in the subject will be available at eGela.

### BIBLIOGRAFÍA

**Basic bibliography**


**Detailed bibliography**

- "GPU Gems 3" Hubert Nguyen
- "Advanced Graphics Programming Using OpenGL" Tom McReynolds, David Blythe

**Journals**

Web sites of interest

http://developoper.nvidia.com
http://www.gamedev.net/
COURSE GUIDE 2021/22

Faculty 163 - Faculty of Engineering - Vitoria-Gasteiz
Degree GIIGS110 - Bachelor's Degree in Computer Engineering in Management and In
Cycle Not Applicable
Year First year

COURSE
26013 - Methodology of Programming
Credits, ECTS: 6

COURSE DESCRIPTION
The subject of Programming Methodology introduces the student to the field of formal software development. In this subject, which is taught after Basic Programming, the basic concepts necessary to create and execute computer programs will be introduced, emphasizing formal specification methods.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
- Capacity to analyse, design, construct and maintain applications in a robust and secure manner
- Capacity to specify, document, validate and verify programs
- Capacity to reason and justify properties related to programs
- Capacity to evaluate and compare specifications and documentation of programs from the quality point of view
- Knowledge of formal specification and program design methods
- Knowledge of basic notions of axiomatic semantics of programming languages
- Knowledge and application of basic algorithmic procedures of IT technologies for the design of solutions to problems, analysing the suitability and complexity of the algorithms proposed

Specific objectives:
- Specification, correction and design by contract
- Formal pre-post specification
- Hoare's formal system
- The equational specification technique
- The formal derivation method

CONTENIDOS TEÓRICO-PRÁCTICOS
- Topic 0: Introduction
- Topic 1: Logical Asserizations
- Topic 2: Specification
- Topic 3: Verification
- Topic 4: Derivation

TEACHING METHODS
In the lectures there will be sessions of concepts exposition, reinforced with examples of situations in which these concepts are to be used.

In the practical part a set of exercises will be developed. The exercises to be carried out pose programming problems that students must perform in the most autonomous way as possible.

During the lectures group work will be carried out systematically, discussing and presenting the results of exercises with the aim of encouraging direct participation in the course and also students' motivation.

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

Evaluation tools and percentages of final mark
Assessment of the subject in the ordinary call is either done through continuous assessment or final assessment. By default, all students will do continuous assessment, unless they withdraw from it.

* Evaluation with final exam
It is allowed to withdraw from continuous assessment to take a single final exam. This withdrawal must be communicated to the professor responsible for the course in the period set out in Article 8 of the Rules for Student Assessment. Withdrawals from continuous assessment will not be accepted after the dates stated, except in exceptional cases.

The exam will test the entire content of the subject. To pass the subject, it is necessary to obtain a minimum mark of 5 out of 10 in the exam.

* Continuous assessment
By default, continuous assessment is the standard method, unless the student has expressly withdrawn from it.

Continuous assessment is done through written tests to demonstrate that knowledge and competences taught in the subject have been acquired.

1) First-order logic (20% of the grade)
2) Sequences and conditionals (20% of the grade)
3) Iterations (30% of the grade)
4) Recursiveness and function calls (30% of the grade)

* Requirements to pass the ordinary call through continuous evaluation without final exam
- Perform all written tests
- Minimum score of 5 in the sum of all the tests
- Minimum score of 25% on each of the tests

* Ordinary final exam:
The only students who can present themselves are those who have passed at least three written tests, although they may not have reached the level required to pass an ordinary call in continuous assessment.

The exam will be divided into four parts, corresponding to each test:
The student may take the parts he/she wishes
The grades from previous tests will be maintained if they are not taken in this exam
The grade of previously taken tests will not be maintained (corresponding to the parts taken in this exam) for the purposes of the calculation of the final grade

* Requirements to pass the ordinary call:
- Have taken all the written tests (in the ordinary final exam or before)
- Minimum mark of 5 in the sum of all the written tests
- Minimum mark of 25% in each written test

* Withdrawal from the exam:
Students following continuous assessment may withdraw from the call as per that stated in Article 12 of the Rules for Student Assessment

* Cases of copying:
Article 11 of the Rules for Student Assessment will be applied.

* Continuous assessment
By default, continuous assessment is the standard method, unless the student has expressly withdrawn from it.
Continuous assessment is done through written tests, in which students must demonstrate that they have acquired the knowledge and competences taught in the subject.
1) First-order logic (20% of the grade)
2) Sequences and conditionals (20% of the grade)
3) Iterations (30% of the grade)
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* Cases of copying:
Article 11 of the Rules for Student Assessment will be applied.

* If the course cannot be assessed face-to-face, the relevant changes will be made to carry it out online by using the IT tools available at the UPV/EHU. The particulars of this online assessment will be made public.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary call consists of an exam on 10 points in which the whole of the subject is evaluated.

To pass the subject, it is necessary to obtain a minimum score of 5 points out of the total of 10 exam points.

To waive the right to the examination, it will be sufficient not to appear. In this case, the qualification will be "No Presented".

* Note that no grade from the ordinary call is kept

* Cases of copying
Article 11 of the Rules for Student Assessment will be applied.

MANDATORY MATERIALS
- Material of the subject (Notes and Laboratories)
- eGela virtual platform of the UPV/EHU for this subject

BIBLIOGRAFIA

Basic bibliography

Detailed bibliography

Journals
- Acta Informatica
- Programming and Computer Software
- Science of Computer Programming
- Software Quality Journal
- Transactions on Software Engineering and Methodology

Web sites of interest
- http://www.sc.ehu.es/jiwluicap/metodologia.html

OBSERVATIONS
Name of subject: 26027 – Decision Support Systems
Qualification: Degree in Computer Management and Information Systems Engineering
Type: Compulsory
Credits: 6 ECTS
Year: 3
Term(s): 2nd
Department: Systems and Automatics Engineering
Language: Spanish

Outcomes / Objectives
1.- Understand the fundamentals of decision support.
2.- Apply the different decision making strategies under uncertainty.
3.- Discuss the nature of the different ways to approach the decision making problem in a variety of contexts and applications.

Syllabus
0.- Introduction to the decision making problem and general presentation of the techniques to use
1.- Bayesian networks
   1.1.- Naive Bayesian method
   1.2.- Notion of graph and its application to Bayesian networks
   1.3.- Inference with Bayesian networks
   1.4.- Need for machine learning for the construction of a Bayesian network
2.- Influence diagrams and decision trees
   2.1.- Definition and construction of influence diagrams and decision trees
   2.1.- Cost-utility analysis
   2.2.- Sensitivity analysis
3.- Machine learning
   3.1.- Supervised neural networks
   3.2.- Unsupervised neural networks
   3.3.- Optimisation algorithms and genetic algorithms
   3.4.- Classifiers and meta-classifiers: ID3, AdaBoost.

Methodology

Teaching Method

Face-to-Face Teaching Hours
<table>
<thead>
<tr>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
<th>Computer sessions</th>
<th>Clinical practice</th>
<th>Workshops</th>
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Student Hours of Non Face-To-Face Activities
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<th>Lectures</th>
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</table>
Assessment System

**General criteria**

→ Written essay exam
→ Practical tasks (exercises, case studies or problems)

**Clarification regarding assessment**

1. Written exam on the first 2 units. 3.5 points over total points. Halfway through the course.
2. Written exam on the last unit. 3.5 points over total points. At the end of the course.
3. Laboratory practice. 3 points over total points. Throughout the course.

If in the first exam the student achieves half the points allocated to that exam, the score achieved will be kept and added to the other scores. Otherwise, the student must sit the second exam, which in that case will be over 7 points and the student will be assessed on all the units. Therefore, students who pass the first exam do not need to take an exam on those units again.

The final score will be the sum of the 3 assessment scores. The passing grade for the subject is a final score of 5, and the sum of the 2 exam scores must be at least 3.5.

**Bibliography**

**Basic Bibliography**

3. Francisco Javier, Díez, Introducción a los modelos gráficos probabilistas, Departamento de Inteligencia Artificial, Uned, Octubre de 2007
4. REDES NEURONALES Y SISTEMAS BORROSOS.
   MARTIN DEL BRIO, BONIFACIO / SANZ MOLINA, ALFREDO

**In-depth Bibliography**

- Sistemas Expertos y Modelos de Redes Probabilisticas, Enrique Castillo y otros, Universidad de Cantabria.

**Journals**

- Decision Support Systems
- IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE
- International Journal of Neural Systems
- IEEE Computational Intelligence Magazine
- JOURNAL OF MACHINE LEARNING RESEARCH

**Websites**

- http://dssresources.com
- http://www.hindawi.com/journals/cin/aims/
- http://siba-ese.unisalento.it/index.php/ejasa_dss
- http://www.hindawi.com/journals/aans/aims/
Centre | University College of Engineering of Vitoria-Gasteiz
---|---
Name of subject | 26029 – Web Systems
Qualification | Degree in Computer Management and Information Systems Engineering
Type | Compulsory
Credits | 6 ECTS
Year | 3
Term(s) | 2nd
Department | Systems and Automatics Engineering
Language | Spanish

### Outcomes / Objectives
This subject deals with the main aspects that support web information systems, tracing the history of the Web, its technological support, the architecture of its applications and basic client- and server-side technologies, as well as information exchange technology (XML). The advanced aspects are concerned with the knowledge of the fundamentals of Web services, the architecture of emerging information systems, and the increasingly more important aspect of security, including an introduction to the protocols that incorporate security elements.

### Syllabus

### Methodology

#### Teaching Method

<table>
<thead>
<tr>
<th>Face-to-Face Teaching Hours</th>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
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<th>Field practice</th>
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<tr>
<th>Student Hours of Non Face-To-Face Activities</th>
<th>Lectures</th>
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<th>Field practice</th>
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</tbody>
</table>
Assessment System

General criteria

Clarification regarding assessment

Compulsory materials

Class notes, teaching support materials in the classroom and laboratories.

Bibliography

Basic Bibliography

In-depth Bibliography

Journals

Websites
- http://www.w3.org/http://www.librosweb.es/
<table>
<thead>
<tr>
<th>Centre</th>
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<tr>
<td>Name of subject</td>
<td>26030 – Database Administration</td>
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<tr>
<td>Qualification</td>
<td>Degree in Computer Management and Information Systems Engineering</td>
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<tr>
<td>Type</td>
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<td>Computer Languages and Systems</td>
</tr>
<tr>
<td>Language</td>
<td>Spanish</td>
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</tbody>
</table>

**Outcomes / Objectives**

- Install and configure a DBMS
- Define user accounts and associated resources and privileges
- Make backup copies and recover the state of the DB after a system failure
- Establish and manage audit controls
- Understand the notion of transaction and its ACID properties. Basic concurrency control concepts
- Have knowledge of concurrency control mechanisms
- Define links between databases on different nodes and work with the multiple databases

**Syllabus**

The Database Administrator:

The general problems of a DBMS and basic administrator tasks are presented. A DBMS is installed and configured ready for start-up.

Security:

The difference between user account and user role. The two DB access control models are presented: privilege-based and level-based, with a focus on the former.

Audit:

The options for performing a DB audit are presented

Recovery:

The options for making backup copies are explained, and how to recover a consistent DB state after a system failure. The notion of Journal is explained, as well as its role in the recovery of a consistent DB state.

Transactions and Concurrency Control:

The concept of transaction is presented. Several concurrency control protocols are presented: reservations, timestamps and validation

Tuning:

Recommendations for DB optimisation are presented. The characteristics offered by DBMS for application performance analysis and tuning of DB settings are analysed.

Distributed data management:

The characteristics offered by DBMS for managing data distribution and replication are presented.
Methodology

Teaching Method

Face-to-Face Teaching Hours

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</table>

Assessment System

General criteria

→ Written essay exam
→ Practical tasks (exercises, case studies or problems)
→ Individual assignments
→ Group assignments

Clarification regarding assessment

Assessment of students in the REGULAR exam session will be by continuous assessment. The final subject grade is calculated based on the scores achieved in 3 midterm exams and exercises and laboratory practice carried out throughout the course.

Students will be deemed to have taken the REGULAR exam session if they have sat at least 2 of the above midterm exams. If a student has not sat at least the 2 midterm exams, the grade will be Not Sat. In any case, students must sit ALL midterm exams to pass the subject. An exam on the entire subject content is not allowed in the regular exam session, except in those cases where an exception is made to the assessment mode as mentioned below.

Students who do not pass in the regular exam session must sit a SUPPLEMENTARY exam where they will be assessed in an exam covering the entire subject content.

EXCEPTION to assessment mode:

- Students may only sit a single exam accounting for 100% of the final grade in exceptional cases where justification has been submitted at the beginning of the year as per article 43 of the current regulations concerning the assessment of students.
- Exceptional cases must be notified to the lecturer at the beginning of the year or as soon as the exceptional circumstance occurs if it takes place after commencement of the term.
- Supporting documentation must be provided to appropriately justify a request for exception.
- No exception requests will be accepted afterwards.
Bibliography

**Basic Bibliography**

- Oracle database 10g new features : Oracle 10g reference for advanced tuning & administration / Mike Ault, Daniel Liu, Madhu Tumma, 2008.

**In-depth Bibliography**

**Journals**

**Websites**

- Oracle Web: technet.oracle.com
COURSE GUIDE 2021/22

Faculty 163 - Faculty of Engineering - Vitoria-Gasteiz  Cycle Not Applicable
Degree GIEIAU10 - Bachelor's Degree in Industrial Electronics and Automation Engineering  Year Fourth year

COURSE
26006 - Extended Industrial Information Technology  Credits, ECTS: 6

COURSE DESCRIPTION
The optional subject of 4th course "Expansion of Industrial Informatics" can be taken from two degrees:
- Degree in Computer Engineering of Management and Information Systems
- Degree in Automatic and Industrial Electronic Engineering

Therefore, it is taken for granted that the capacities and knowledge of the students at the beginning of course will be very different.

In any case, it is advisable to have programming knowledge, whether on PC platforms or other more specific ones.

Given its terminal nature of the subject, a practical and updated approach will be given to the subject, without losing the rigor in the treatment of content.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
- TEEOI10 - Applied knowledge of industrial computing and communications.

The transversal competences of the module with which there is an identification on the part of the subject are:
- C10 - Ability to work in a multilingual and multidisciplinary environment.
- C13 - Apply the strategies of the scientific methodology: analyze the situation and problems qualitatively and quantitatively. Raise hypotheses and solutions using engineering models.

In addition to those mentioned:
- The student is able to write reports at the level corresponding to the course
- Capacity for innovation and creativity
- Autonomous Learning

CONTENIDOS TEÓRICO-PRÁCTICOS
- Introduction
- Industry 4.0
- Infrastructure
- Applications
- Technologies in development
- High-level elements

TEACHING METHODS
The teaching methodology is based on cooperative learning, mainly using group work and autonomous learning.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Types 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>
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<tbody>
<tr>
<td>Hours of face-to-face teaching</td>
<td>30</td>
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</table>

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

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

Evaluation tools and percentages of final mark
- Written test, open questions  20%
- Exercises, cases or problem sets  40%
- Teamwork assignments (problem solving, Project design)  40%
According to the Regulations governing the Evaluation of Students in official Bachelor's degrees, chapter II, article 8, section 3, all students will have the right to be evaluated through the final evaluation system, regardless of whether or not they have participated in the system continuous evaluation. To do this, students must submit in writing to the teaching staff responsible for the subject the waiver of continuous assessment. The students will have a period of 9 weeks from the beginning of the subject, in accordance with the academic calendar of the center.

If a student wishes to waive the Ordinary Call, he may do so by writing to the teaching staff of the subject before the start date of the exams of the call or by not taking the final test, if any.

If there is a final written test, a minimum qualification of 4/10 must be obtained in order to pass the subject.

"In the event that a face-to-face evaluation of the subject cannot be carried out for reasons associated with the health situation, the evaluation will be adapted to the current situation".

The same criteria will be used as in the Ordinary Call. In this sense, the necessary tests will be carried out to ensure an adequate evaluation of the subject.

If applicable, the qualifications corresponding to the continuous evaluation of the subject may be kept.

"In the event that a face-to-face evaluation of the subject cannot be carried out for reasons associated with the health situation, the evaluation will be adapted to the current situation".

The teaching materials will be made available to through the e-gela platform or the teacher's website.

BIBLIOGRAFÍA

Basic bibliography
BARR AND MASSA Programming Embedded Systems: with C and GNU development Tools, O'Reilly


STALLINGS, W. 2005. Sistemas Operativos. 5 Ed. (Prentice-Hall)

CASTRO, M. y otros 2007 Comunicaciones Industriales: Sistemas Distribuidos y Aplicaciones. Ed. UNED,

Detailed bibliography
If necessary, additional in-depth bibliography as well as on-line references will be provided during the development of the subject.

Journals
If necessary, additional in-depth bibliography as well as on-line references will be provided during the development of the subject.

Web sites of interest
If necessary, additional in-depth bibliography as well as on-line references will be provided during the development of the subject.

OBSERVATIONS
The general objective of the course is to design and implement applications, the requirements of which have been previously captured. To develop software products following a systematic process, active methodologies and multi-layer software architectures will be applied, relying on tools that improve the quality of the software.

To be able to study Software Engineering without undue difficulty, it is recommended to have previously acquired the following skills:

- In the "Modular and Object Oriented Programming" subject:
  * Know and understand the fundamentals of the Object Orientation paradigm and the corresponding elements in an Object Oriented programming language
  * Understand the difference between classes and objects; the relationship between classes, inheritance and polymorphism
  * Develop small programs applying all the concepts about programming acquired
  * Knowledge and use of exceptions as an error control mechanism for the correct operation of programs
- In the subject "Data Structures and Algorithms" subject:
  * Knowledge and ability to apply Abstract Data Types to problems of medium complexity: Lists, Stacks, Queues, Hash Tables, Trees and Graphs
  * Knowledge and ability to analyze the main algorithms for the treatment of data structures: Search, Sorting, and Enumeration
  * Ability to efficiently select, design and implement the best data structure for solving a problem

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

C1: Know how to distinguish the various stages that make up any software engineering process.
C2: Know how to understand an object-oriented software system in the UML language.
C3: Know how to design a software system in a multi-layer architecture based on the analysis previously conducted.
C4: Know how to implement a system based on the design of the application.

Transversal competencies:

C9b: Know how to communicate and transmit knowledge, abilities and skills of the profession of Computer Engineering

CONTENIDOS TEÓRICO-PRÁCTICOS

UT1: Introduction to Software Engineering
  - Motivation and life cycle of the software
  - Objectives, properties and associated programming technologies.
UT2: Specification of UML artifacts
  - Study of the different artifacts existing in UML
UT3: Multi-layer software architectures: Presentation, Business Logic and Data
  - Design of the different layers that make up a software system
UT4: Object Oriented Design and Programming
  - Functionality design
UT5: Implementation of a specific product
  - Implementation of a software system using a set of languages and current tools

TEACHING METHODS

As it is a substantially practical subject, the MASTER classes (M) will be used for the exposition of the theoretical concepts necessary in the practical classes, as well as for the resolution of doubts raised by the students. In the same way, the concepts acquired through the resolution of exercises will be reinforced, either individually or in small groups.

As it is a substantially practical subject, the MASTER classes (M) will be used for the exposition of the theoretical concepts necessary in the practical classes, as well as for the resolution of doubts raised by the students. In the same way, the concepts acquired through the resolution of exercises will be reinforced, either individually or in small groups.

The COMPUTER PRACTICES (CP) classes will be used to apply the active Project-Based Learning methodology. At the
beginning of the semester, students will be provided with a project statement that realistically brings together the contents of the subject. They will carry out this project in groups of 2-4 people, following the agile SCRUM methodology. This methodology proposes to develop the project in an incremental way, through successive iterations, in each of which a partial product is obtained that adds new functionality to the previous one. Each iteration is also associated with the realization of its corresponding documentation.

**TYPES OF TEACHING**

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

**Evaluation tools**

- End-of-course evaluation

**Evaluation tools and percentages of final mark**

- Written test, open questions 60%
- Teamwork assignments (problem solving, Project design) 40%

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

The evaluation of the subject in the ORDINARY call will be made through continuous evaluation or final evaluation. By default, all students will take continuous assessment, unless they resign it.

* EVALUATION THROUGH FINAL EVALUATION

The student can renounce the continuous evaluation to carry out the final evaluation. This resignation must be submitted in writing to the responsible teachers within the terms stipulated in Article 18 of the regulations on student assessment. Exceptional cases or waivers of continuous evaluation will not be accepted after the dates enabled for it.

Students who have waived continuous assessment will undergo a single exam for 100% of the subject in which all aspects of the subject will be evaluated (including the skills worked on in the project).

* CONTINUOUS ASSESSMENT

The default assessment of the subject is done through continuous assessment, unless the student has expressly waived it.

The final grade for the course is calculated based on the test scores and a project to be developed as a team. The final grade is calculated with the following weights:
- 40% based on a series of deliveries on a project (deliverables).
- 60% by taking different tests that will always include 3 exams.

In this evaluation, the student takes three exams throughout the semester. The grades obtained in the different evaluables (partial exams and project) are kept throughout the course, but not for subsequent years.

The student must obtain an average grade of at least 4 out of 10 in each of the exams for the practice to be counted. Otherwise, the grade obtained will be the average of the exams (and in no case will it exceed 4 points out of 10).

If it is not possible to carry out a face-to-face evaluation of the subject, the pertinent changes will be made to do it online by using the existing computer tools at the UPV / EHU. The characteristics of this online evaluation will be made public.

* WAIVER OF THE RIGHT TO EXAM

The student or the student who, having selected to take the final evaluation, does not appear for the exam in the ordinary call, will obtain the final grade "Not Presented".

The students who follow the continuous evaluation may make the waiver of the call in accordance with the provisions of Article 12 of the regulations on student evaluation.

* COPY CASES:
Article 11 of the current regulations regarding the evaluation of students will apply.
EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students who have waived continuous assessment will undergo a single exam for 100% of the subject in which all aspects of the subject will be evaluated (including the skills worked on in the project).

The rest of the students will be evaluated through an exam that represents 60% of the final grade and the part corresponding to the project (40% of the final grade). Those students who have not passed will take an exam of this part. The student must obtain an average grade of at least 4 out of 10 in the section corresponding to the exam for the practice to be counted. Otherwise, the grade obtained will be the exam grade.

To waive the right to the exam, it will be enough to not show up.

If it is not possible to carry out a face-to-face evaluation of the subject, the pertinent changes will be made to do it online by using the existing computer tools at the UPV / EHU. The characteristics of this online evaluation will be made public.

* COPY CASES:
Article 11 of the current regulations regarding the evaluation of students will apply.

MANDATORY MATERIALS

<table>
<thead>
<tr>
<th>Institute</th>
<th>Title</th>
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<tr>
<td>Ingeniería del Software</td>
<td>Un enfoque práctico</td>
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BIBLIOGRAFÍA

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<td>Design Patterns</td>
<td>Elements of Reusable Object-Oriented Software</td>
<td>Erich Gamma, Richard Helm, Ralph Johnson, John M. Vlissides</td>
<td>1995</td>
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<tr>
<td>A Pattern Language: Towns, Buildings, Construction</td>
<td>Christopher Alexander, Sara Ishikawa, Murray Silverstein</td>
<td>1977</td>
<td></td>
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<tr>
<td>Java 8 in Action</td>
<td>Lambdas, streams, and functional-style programming</td>
<td>Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft</td>
<td>Manning</td>
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Detailed bibliography

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<tbody>
<tr>
<td>Object Oriented Software Construction</td>
<td>Bertrand Meyer</td>
<td>Prentice-Hall</td>
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Journals

Web sites of interest

- http://www.uml.org/
- http://www.visual-paradigm.com/product/vpuml/

Books about design patrones:

- http://hillside.net/patterns/books/
- http://www.javacamp.org/designPattern/
- http://www.dofactory.com/net/design-patterns

OBSERVATIONS

The concepts covered in the subjects "Modular and Object Oriented Programming" and "Data Structures and Algorithms" are required for this subject. To take this subject, you should have passed or at least completed these subjects.