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

### FACULTY OF ENGINEERING - VITORIA-GASTEIZ (163)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
<th>Credits</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>25974</td>
<td>Fundamentos Físicos de la Ingeniería</td>
<td>Annual</td>
<td>12</td>
<td>M</td>
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<tr>
<td>25975</td>
<td>Fundamentos Químicos de la Ingeniería</td>
<td>Annual</td>
<td>9</td>
<td>M</td>
</tr>
<tr>
<td>25984</td>
<td>Mecánica Aplicada</td>
<td>Annual</td>
<td>9</td>
<td>A</td>
</tr>
<tr>
<td>26031</td>
<td>Programación Básica</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
<td>M</td>
</tr>
<tr>
<td>26018</td>
<td>Arquitectura de Computadores</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>26021</td>
<td>Lenguajes, Computación y Sistemas Inteligentes</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
<td>A</td>
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<tr>
<td>26025</td>
<td>Sistemas de Gestión de Seguridad de Sistemas de Información</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6,5</td>
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<tr>
<td>26036</td>
<td>Desarrollo de Sistemas Gráficos</td>
<td>Sep. 2020- Jan. 2021</td>
<td>4,5</td>
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<tr>
<td>26005</td>
<td>Sistemas Empotrados</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>26046</td>
<td>Cinemática y Dinámica de Máquinas</td>
<td>Sep. 2020- Jan. 2021</td>
<td>9</td>
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<tr>
<td>26045</td>
<td>Elasticidad y Resistencia de Materiales</td>
<td>Sep. 2020- Jan. 2021</td>
<td>9</td>
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<tr>
<td>25999</td>
<td>Informática Industrial</td>
<td>Sep. 2020- Jan. 2021</td>
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<td>25988</td>
<td>Tecnologías Ambientales</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
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<tr>
<td>26023</td>
<td>Investigación operativa</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
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<tr>
<td>28126</td>
<td>Cálculo y Diseño de Estructuras Automovilísticas</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
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<tr>
<td>28134</td>
<td>Aerodinámica</td>
<td>Sep. 2020- Jan. 2021</td>
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<tr>
<td>28138</td>
<td>Procesos de Fabricación en Tecnología Automotriz</td>
<td>Sep. 2020- Jan. 2021</td>
<td>6</td>
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<tr>
<td>26013</td>
<td>Metodología de la Programación</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>M</td>
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<tr>
<td>26017</td>
<td>Ingeniería del Software</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>26027</td>
<td>Sistemas de Apoyo a la Decisión</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>M</td>
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<tr>
<td>26029</td>
<td>Sistemas Web</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>M</td>
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<tr>
<td>25985</td>
<td>Sistemas de Producción y Fabricación</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>A</td>
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<tr>
<td>25996</td>
<td>Sistemas Electrónicos Digitales</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>M</td>
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<tr>
<td>26006</td>
<td>Ampliación de Informática Industrial</td>
<td>Jan. 2021 - May 2021</td>
<td>6</td>
<td>A</td>
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<tr>
<td>Código</td>
<td>Curso</td>
<td>Periodo</td>
<td>Créditos</td>
<td>Horario</td>
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<tr>
<td>26050</td>
<td>Instalaciones y Máquinas Hidráulicas</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>M</td>
</tr>
<tr>
<td>26091</td>
<td>Química Industrial</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>M</td>
</tr>
<tr>
<td>26007</td>
<td>Control por Computador</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>A</td>
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<tr>
<td>28122</td>
<td>Introducción a la Mecánica</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>M</td>
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<tr>
<td>26030</td>
<td>Administración de Bases de Datos</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>M</td>
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<tr>
<td>25979</td>
<td>Mecánica de Fluidos</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>A</td>
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<tr>
<td>28132</td>
<td>Simulación y Análisis FEM en Automoción</td>
<td>Jan. 2021-May 2021</td>
<td>6</td>
<td>A</td>
</tr>
</tbody>
</table>

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>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
</tr>
<tr>
<td>96.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student Hours of Non Face-To-Face Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
</tr>
<tr>
<td>144.0</td>
</tr>
</tbody>
</table>

**Clarification regarding the methodology**

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

Some classroom practice sessions (GA) 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.merlot.org/artifact/BrowseArtifacts.po?catcode=113&amp;browsecat=100
- http://www.fisicahoy.com/
1. Contextualization and 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.
2. Competences / Learning outcomes of the subject

2.1. COMPETENCES

2.1.1. 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.

2.1.2. Transversal competences

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

2.2. 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).
3. Theoretical/practical content

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.
4. Methodology

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 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.
## 5. Type of teaching

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
<th>TI</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom hours</td>
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<td>30</td>
<td>15</td>
<td></td>
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<tr>
<td>Hours of study outside the classroom</td>
<td>67.5</td>
<td>45</td>
<td>22.5</td>
<td></td>
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</tr>
</tbody>
</table>

M: Magistral  
S: Seminar  
GA: Classroom practices  
GL: Laboratory practices  
GO: Computer practices  
GCL: Clinical practices  
TA: Workshop  
TI: Industrial workshop  
GCA: Field workshop
6. Ordinary exam call (Guidelines & declining to sit)

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.
7. **Extraordinary exam call: guidelines & declining to sit**

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.
8. Compulsory materials

Collections of problems and specific questions related to the subject.
9. Bibliography

BASIC BIBLIOGRAPHY

NOMENCLATURE OF INORGANIC CHEMISTRY

GENERAL CHEMISTRY

LABORATORY PRACTICES

IN-DEPTH BIBLIOGRAPHY

USEFUL WEBSITES

http://www.egela.ehu.es

http://www.ptable.com/?lang=es

26031- BASIC PROGRAMMING/ PROGRAMACIÓN BÁSICA

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 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.

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.

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, laboratory work and individual practical work.

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 be 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 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.

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 passed 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.
Centre | University College of Engineering of Vitoria-Gasteiz
---|---
Name of subject | 26018 – Computer Architecture
Qualification | Degree in Computer Management and Information Systems Engineering
Type | Compulsory
Credits | 6 ECTS
Year | 2
Term(s) | 1st
Department | Systems and Automation Engineering
Language | Spanish

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>
<th>Industrial workshops</th>
<th>Field practice</th>
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### Student Hours of Non Face-To-Face Activities

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<thead>
<tr>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
<th>Computer sessions</th>
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<td>30</td>
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</table>

## 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 ARQUITECTURE. A QUANTITATIVE APPROACH.**

- **ORGANIZACION DE COMPUTADORES.**

- **ORGANIZACION Y ARQUITECTURA DE COMPUTADORES.**

### In-depth Bibliography

## Websites

- [Link]
<table>
<thead>
<tr>
<th>Centre</th>
<th>University College of Engineering of Vitoria-Gasteiz</th>
</tr>
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<tr>
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<td>26021 – Languages, Computation and Intelligent Systems</td>
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<tr>
<td>Qualification</td>
<td>Degree in Computer Management and Information Systems Engineering</td>
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<td>Type</td>
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<td>Credits</td>
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<td>Year</td>
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<td>Term(s)</td>
<td>1st</td>
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<tr>
<td>Department</td>
<td>Computer Languages and Systems</td>
</tr>
<tr>
<td>Language</td>
<td>Spanish</td>
</tr>
</tbody>
</table>

**Outcomes / Objectives**

Automata, grammars, formal languages, computability, complexity, programming paradigms, intelligent systems.

**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>
<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>Seminars</th>
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<th>Lab. practice</th>
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</tr>
</tbody>
</table>

Assessment System

General criteria

Clarification regarding assessment

Bibliography

Basic Bibliography


In-depth Bibliography

S.H. RODGER, T.W. FINLEY; "JFLAP: An Interactive Formal Languages and Automata Package". Jones and Bartlett, 2006

Websites

- Java Computability Tool kit (JCT): http://humboldt.sunyit.edu/jct/
- Visual and interactive tools (JFLAP): http://www.jflap.org/
- Java implementation of AI algorithms: http://code.google.com/p/aima-java/
Centre | University College of Engineering of Vitoria-Gasteiz
---|---
Name of subject | 26025 – Information Systems Security Management Systems
Qualification | Degree in Computer Management and Information Systems Engineering
Type | Compulsory
Credits | 6 ECTS
Year | 3
Term(s) | 1st
Department | Computer Languages and Systems
Language | Spanish

**Outcomes / Objectives**

Overview of the different areas covered by Computer Security and of the security issues derived from the use of computer equipment and applications.

Processes of conception, planning and implementation of reasonable security policies and measures in professional environments, making an approach to the knowledge of ISMSs.

Integration of computer security technical knowledge in the ethical, legal and organisational areas.

**Syllabus**

Information Systems Security Risk Analysis and Management.

Backing up information and back-up copies

Information resource access control: identification and authentication. The digital signature.

Malicious software: security risks and measures

The human factor

Information encoding: usage contexts and basic techniques

Software protection

Planning, organising and administering computer security, audits: techniques and standards

Legal, ethical and organisational aspects: LOPD (Data Protection Act), LSSI (Information Society Services Act) and the Electronic Signature Act.

**Methodology**

**Teaching Method**

<table>
<thead>
<tr>
<th>Face-to-Face Teaching Hours</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>Seminars</td>
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<thead>
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<tbody>
<tr>
<td>Lectures</td>
<td>Seminars</td>
</tr>
<tr>
<td>80</td>
<td>10</td>
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</tbody>
</table>
Assessment System

General criteria
→ Written essay exam
→ Multiple-choice test
→ Oral exam
→ Practical tasks (exercises, case studies or problems)
→ Individual assignments
→ Group assignments
→ Presentation of assignments, readings...

Compulsory materials

Class notes, teaching support materials in the classroom and laboratories. LOPD (Data Protection Act), LSSI (Information Society Services Act) and Digital Signature Act.

Bibliography

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.

In-depth Bibliography

Journals
➢ Auditoría + Seguridad informática
➢ IEEE Security & Privacy

Websites
➢ www.agpd.es
➢ www.criptored.upm.es
➢ www.intypedia.com
➢ www.rediris.es/cert
➢ www.inteco.es/Seguridad
Centre | University College of Engineering of Vitoria-Gasteiz  
---|---  
Name of subject | 26036 – Graphics Systems Development  
Qualification | Degree in Computer Management and Information Systems Engineering  
Type | Elective  
Credits | 4.5 ECTS  
Year | 4  
Term(s) | 1st  
Department | Computer Languages and Systems  
Language | Spanish

**Outcomes / Objectives**

Study of the development of applications with 2D and/or 3D graphical interfaces, from the hardware and the use of already developed graphics engines to commonly used programming interfaces.

**Syllabus**

1. Introduction to graphics systems. Definitions. Abstraction layers. Hardware, API, graphics engines, application. Basic concepts in graphics applications.
4. Graphics engines. Introduction to graphics engines. OGRE.
5. Architecture of a graphics application.

**Methodology**

**Teaching Method**

| Face-to-Face Teaching Hours |  |
|---|---|---|---|---|---|---|---|---|---|---|
| Lectures | Seminars | Classroom practice | Lab. practice | Computer sessions | Clinical practice | Workshops | Industrial workshops | Field practice |
| 15 | 30 |  |

| Student Hours of Non Face-To-Face Activities |  |
|---|---|---|---|---|---|---|---|---|---|
| Lectures | Seminars | Classroom practice | Lab. practice | Computer sessions | Clinical practice | Workshops | Industrial workshops | Field practice |
| 17,5 | 50 |  |
Assessment System

General criteria
→ Individual assignments.

Bibliography

Basic Bibliography
- "OpenGL(R) Programming Guide: The Official Guide to Learning OpenGL(R)", Versión 2.1 OpenGL ARB, Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis

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

Websites
- http://www.developer.nvidia.com
- http://www.gamedev.net/
- http://www.gamasutra.com/
COURSE GUIDE 2020/21

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

COURSE

26005 - Embedded Systems  Credits, ECTS: 6

COURSE DESCRIPTION

Embedded systems is a 4th year optional subject that pursues learning a set of modern tools. It is an eminently practical subjects studying current microcontroller architecture and tools employed in developing microcontroller based systems nowadays. It follows the 3th year starting subject about microcontrollers (Digital Electronic Systems) but focuses on 32-bit architectures, tools and stacks. It complements the subject Industrial Informatics.

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 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.

COURSE CONTENTS, THEORETICAL & APPLIED

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>
<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>
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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
- 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 grade. 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).

### BIBLIOGRAPHY

#### Basic bibliography
- STM32F769NI Datasheet
- 32F746GDISSCOVERY 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.
<table>
<thead>
<tr>
<th>Centre</th>
<th>University College of Engineering of Vitoria-Gasteiz</th>
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</thead>
<tbody>
<tr>
<td>Name of subject</td>
<td>26046 – Kinematics and Dynamics of Machines</td>
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<tr>
<td>Qualification</td>
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<td>Department</td>
<td>Mechanical Engineering</td>
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<td>Language</td>
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</table>

**Outcomes / Objectives**

Understand the structure of mechanisms: elements and kinematic pairs of mechanisms, number of degrees of freedom of mechanism, concept of kinematic chain.

Learn the fundamental theorems of planar motion, complementing what has been learnt in the course of Applied Mechanics, as a theoretical basis for the dimensional analysis and synthesis of mechanisms.

Acquire capabilities to perform the kinematic analysis of planar mechanisms. Study of rotativity, singular position analysis and obtaining quality parameters of mechanisms.

Carry out the direct and inverse dynamic analysis of planar mechanisms (rigid body hypothesis) based on the principles studied in Applied Mechanics and through specific procedures for desmodromic mechanisms.

Carry out the deformable body dynamic analysis of single- and multiple-degree-of-freedom systems.

Acquire capabilities to analyse planar cams. Notions of the different types of cams and their applications.

Study the kinematics and dynamics of gears, in particular cylindrical gears. Notions of the capabilities of gear systems.

**Syllabus**

Unit 1: Basic concepts of mechanisms and machines.
Unit 2: Geometry of the planar motion.
Unit 3: Kinematic analysis of planar mechanisms.
Unit 4: Kinematics of cams.
Unit 5: Kinematics of gears.
Unit 6: Inverse dynamics problem.
Unit 7: Direct dynamics problem.
Unit 8: Theory of vibrations.

**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>Clinical practice</th>
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<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
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</tbody>
</table>
Assessment System

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

Bibliography

Basic Bibliography
➢ Guía del estudiante para el curso 2012-2013
➢ Colección de enunciados de examen de Cinemática y Dinámica de Máquinas 2005 – 2012
➢ Lecturer’s software:
  • MECAN4 (Hernández, A.; Casado, H.; Castillo, J; Urruchi, J.V.; Abascal, L.; Pinto, Ch.)
  • BIEMAN (Hernández, A.; Alonso, A.; Macho, E.; Petuya, V.)
  • Pinto, Ch.; Agirrebeitia, J; Petuya, V.; Hernández, A. MANUAL DE USUARIO DE MECAN4 Y BIEMAN.

In-depth Bibliography

Websites
➢ http://www.biblioteka.ehu.es Página web de la biblioteca de la UPV/EHU.
➢ www.thinkmotion.eu Página web del proyecto thinkMOTION para la creación de una base datos europea online sobre contenidos de Teoría de Máquinas.
➢ www.dmg-lib.org Librería online sobre modelos mecánicos, bibliografía e investigadores alemanes.
  • www.technologystudent.com Ejercicios sobre análisis y diseño de sistemas mecánicos.
➢ www.howstuffworks.com Videos y animaciones sobre el funcionamiento de diferentes sistemas mecánicos.
➢ www.tribology-abc.com Herramientas para la cálculo online de diferentes elementos de máquinas.
### COURSE GUIDE 2020/21

<table>
<thead>
<tr>
<th>Faculty</th>
<th>163 - Faculty of Engineering - Vitoria-Gasteiz</th>
<th>Cycle</th>
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<td>Year</td>
<td>Third year</td>
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### COURSE

| 26045 - Elasticity and Strength of Materials | Credits, ECTS: 9 |

### 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.

### COURSE CONTENTS, THEORETICAL & APPLIED

- 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>
<th>S</th>
<th>GA</th>
<th>GL</th>
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<th>GCL</th>
<th>TA</th>
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<tbody>
<tr>
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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
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- TA: Workshop
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- GCA: Applied fieldwork groups

**Evaluation tools and percentages of final mark**

- Written test, open questions 80%
- Individual assignments 20%

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

The written tests to be developed are detailed below:
- A midterm exam will be held. The final exams will be attended with pending material. The final mark of the exams will be the average of the two parts.
- The deliverables to be carried out will consist of different tasks that will be described throughout the course, including the laboratory practices. Some should be done individually, others in groups. Some of them will be face-to-face and will take place in class.
- In the event that presential evaluation of the subject cannot be carried out, the pertinent changes will be made to carry out an on-line evaluation by using the IT tools available 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**

idem

**MANDATORY MATERIALS**

Teachers notes.

**BIBLIOGRAPHY**

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

**Detailed bibliography**
- 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://egela.ehu.eus

**OBSERVATIONS**
### Centre
University College of Engineering of Vitoria-Gasteiz

### Name of subject
25999 – Industrial Informatics

### Qualification
Degree in Industrial Electronic Engineering and Automatics

### Type
Compulsory

### Credits
6 ECTS

### Year
3

### Term(s)
1st

### Department
Systems and Automation Engineering

### Language
Spanish

---

**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

Face-to-Face Teaching Hours

| Lectures | Seminars | Classroom practice | Lab. practice | Computer sessions | Clinical practice | Workshops | Industrial workshops | Field practice |
|----------|----------|--------------------|---------------|-------------------|-------------------|-----------|---------------------|----------------|}
| 36       | 6        | 18                 |               |                   |                   |           |                     |                |

Student Hours of Non Face-To-Face Activities

| Lectures | Seminars | Classroom practice | Lab. practice | Computer sessions | Clinical practice | Workshops | Industrial workshops | Field practice |
|----------|----------|--------------------|---------------|-------------------|-------------------|-----------|---------------------|----------------|}
| 36       | 14       | 40                 |               |                   |                   |           |                     |                |

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)
<table>
<thead>
<tr>
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<td>Qualification</td>
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### Outcomes / Objectives

**OUTCOMES**

C1. Ability to write and develop projects aimed at the construction, conservation, installation, assembly or operation of industrial facilities, equipment and plants in the area of the environment applying knowledge of Industrial Engineering.

C2. Ability to direct activities in the area of environmental technology focused on the industry framework.

C3. Knowledge of environmental issues, in particular in relation to pollution and pollution prevention in the three large areas of air, water and waste, providing students with sufficient knowledge to perform environmental audits in industry.

C4. Develop problem solving and decision making skills, as well as critical thinking skills and the ability to transmit knowledge, in the field of industrial technology.

C5. Knowledge required to perform calculations, carry out studies and write reports in the environmental sector.

C7. Ability to analyse and assess the environmental impact of technical solutions.

C10. Ability to work in a multidisciplinary environment.

C11. Be able to use relevant bibliographic sources correctly to obtain, understand and interpret scientific-technical information regarding environmental technology.

C12. Adopt a responsible, orderly attitude at work, and be willing to learn.

**BRIEF DESCRIPTION OF THE CONTENT**

1. Introduction to Environmental Technology.


**OBJECTIVES**

To achieve a minimum level of training in environmental issues, in particular in relation to pollution and pollution prevention in the three large areas of air, water and waste, providing students with sufficient knowledge to perform environmental audits in industry.
Syllabus

1. INTRODUCTION
1.1. Sustainability
1.2. Ecological concepts and natural resources
1.3. Definitions of human impact and pollution.
1.4. Introduction to environmental audit and industry

2. ATMOSPHERIC POLLUTANTS I: BASIC CONCEPTS, TYPES AND SOURCES
2.1. Classification of atmospheric pollutants
2.2. Sources of atmospheric pollution
2.3. Atmospheric pollutants

3. ATMOSPHERIC POLLUTANTS II: EFFECTS AND MEASUREMENT
3.1. Effects of atmospheric pollution
3.2. Measurement of atmospheric pollution

4. DISPERSION OF POLLUTANTS IN THE ATMOSPHERE
4.1. Dynamics of the atmosphere
4.2. Factors affecting the dispersion of pollutants

5. GASEOUS EFFLUENT TREATMENT PROCESSES I: REMOVAL OF PARTICLES BY MECHANICAL METHODS
5.1. Separation by gravity: sedimentation chambers
5.2. Separation by centrifugal force: cyclones
5.3. Separation by filtration

6. GASEOUS EFFLUENT TREATMENT PROCESSES II: REMOVAL OF PARTICLES BY WASHING MACHINES AND ELECTROSTATIC PRECIPITATORS
6.1. Wet separators
6.2. Electrostatic precipitators
6.3. Comparison of PARTICLE REMOVAL equipment

7. GASEOUS EFFLUENT TREATMENT PROCESSES III: REMOVAL OF GASEOUS POLLUTANTS BY TRANSFER
7.1. Absorption
7.2. Adsorption
7.3. Condensation

8. GASEOUS EFFLUENT TREATMENT PROCESSES IV: REMOVAL OF GASEOUS POLLUTANTS BY TRANSFORMATION
8.1. Chemical transformation
8.2. Biological transformation. Biofilters
8.3. Control technique selection criteria

9. POLLUTION CONTROL SYSTEMS FOR SOME SPECIFIC POLLUTANTS
9.1. Sulphur oxides
9.2. Nitrogen oxides
9.3. Volatile organic compounds

10. WATER POLLUTION
10.1. Quality criteria and measurement of water pollution
10.2. Water pollutants and their effects
10.2. Discharge regulations

11. LIQUID EFFLUENT TREATMENT PROCESSES I: PHYSICAL TREATMENTS
11.1. Grilles
11.2. Screens
11.3. Sedimentation
11.4. Filtration
11.5. Flotation

12. LIQUID EFFLUENT TREATMENT PROCESSES II: CHEMICAL AND PHYSICAL-CHEMICAL TREATMENTS
12.1. Neutralisation
12.2. Coagulation/flocculation
12.3. Chemical precipitation
12.4. Adsorption
12.5. Ionic exchange
12.6. Membrane processes
12.7. Stripping
12.8. Oxidation processes

13. LIQUID EFFLUENT TREATMENT PROCESSES III: AEROBIC BIOLOGICAL TREATMENTS
13.1. Aerobic metabolism
13.2. Aerobic treatment systems with suspended biomass
13.3. Aerobic treatment systems with fixed biomass
14. LIQUID EFFLUENT TREATMENT PROCESSES IV: ANAEROBIC BIOLOGICAL TREATMENTS AND REMOVAL OF NUTRIENTS
14.1. Anaerobic metabolism and process parameters
14.2. Anaerobic treatment systems with suspended biomass
14.3. Anaerobic treatment systems with fixed biomass
14.4. Comparison of biological treatment systems
14.5. Biological nutrient removal

15. SLUDGE TREATMENT AND MANAGEMENT PROCESSES
15.1. Characterisation of water treatment plant sludge
15.2. Treatment processes
15.3. Sludge evacuation

16. GENERAL DIAGRAM OF AN URBAN WASTEWATER TREATMENT PLANT
16.1. Pre-treatment
16.2. Primary treatment
16.3. Secondary treatment
16.4. Sludge line

17. URBAN SOLID WASTE I: CHARACTERISTICS, MANAGEMENT AND RECYCLING
17.1. Definition, origin and production of urban solid waste
17.2. Properties of urban solid waste
17.3. Principles of waste management
17.4. Storage, collection and transport of urban solid waste
17.5. Recovery and recycling of urban solid waste

18. URBAN SOLID WASTE II: TREATMENTS AND DISPOSAL
18.1. Biological treatments
18.2. Heat treatments
18.3. Controlled disposal

19. INDUSTRIAL AND HAZARDOUS WASTE
19.1. Definition and generation of hazardous waste
19.2. Labelling and transport of hazardous waste
19.3. Recovery and recycling
19.4. Treatments
19.5. Stabilisation and solidification
19.6. Secure landfill

20. OTHER WASTE
20.1. Agricultural and forestry waste
20.2. Livestock farming waste
20.3. Construction and demolition waste
20.4. Mines and quarries
20.5. Fly ash from thermal power stations
20.6. Disused tyres
20.7. Disused vehicles
20.8. Hospital waste
20.9. Radioactive waste

Methodology

Teaching Method

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<th>Lectures</th>
<th>Seminars</th>
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</table>
Assessment System

General criteria

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

Clarification regarding assessment

The subject can be passed by either sitting an essay exam in the official examination sessions, or partially as follows:

• Essay theory exam with a value of up to 6.0 points
• Academically supervised assignment with a value of up to 2.5 points
• Practical exercises or problems with a value of up to 0.5 points
• Visits to companies in relation to the subject matter of the course, or alternatively, oral presentation of the submitted report, with a value of up to 1.0 point

Bibliography

Basic Bibliography

➤ Baird, C. "Química ambiental” (2001) Barcelona
➤ Metcalf & Eddy "Ingeniería de las aguas residuales. Tratamiento, vertido y reutilización” (2001) Madrid
➤ Ramallo, R.S. ”Tratamiento de aguas residuales” (1996) Barcelona

In-depth Bibliography

➤ Tchobanoglous, G., Kreith, F. ”Handbook of solid waste management” Mcgraw-Hill (2002) EEUU.
➤ Williams, P.T. ”Waste treatment and disposal”. Wiley (2005) Gran Bretaña

Magazines

➤ Ingeniería del Agua, Tecnología del Agua, Química Industrial, Biomass and Bioenergy, Enviromental Engineering Science.
**TEACHING GUIDE** 2019/20

<table>
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**SUBJECT**

| 26023 - Operations Research | ECTS Credits: 6 |

**DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT**

"Operational Research" is an area of study that 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).

**THEORETICAL/PRACTICAL CONTENT**

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.

**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.
### Types of Teaching

<table>
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<th>S</th>
<th>GA</th>
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<th>TA</th>
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</table>

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

### Assessment Systems

- Final assessment system

### Tools Used & Grading Percentages

- Extended written exam: 60%
- Team work (problem solving, project design): 20%
- Actividades en el aula virtual: 20%

### Ordinary Exam Call: Guidelines & Declining to Sit

Final exam: 60% (a minimum result of 4.5/10 is asked). Continuous evaluation by means of exercises gathered along the semester (20%). Work in group (20%).

Students who do not want to follow the aforementioned evaluation system will have the possibility to be evaluated only with a final exam.

Students will abide with all pertinent rules about the evaluation, in particular they will keep in mind the following norms:
- Students's regulation: [https://www.ehu.eus/documents/3026289/3106907/Reglamento_Alumnado_UPV_EHU.pdf](https://www.ehu.eus/documents/3026289/3106907/Reglamento_Alumnado_UPV_EHU.pdf)
- Code of ethics: [https://www.ehu.eus/documents/2100129/0/6.-+b%29+Protocolo+plagio+cas+-+.pdf/11f13960-d46a-cf5a-ac13-eblb5ad10acd](https://www.ehu.eus/documents/2100129/0/6.-+b%29+Protocolo+plagio+cas+-+.pdf/11f13960-d46a-cf5a-ac13-eblb5ad10acd)

During the final exam study notes can be used provided students meet the following criteria:
- a) the material for consultation is for each specific student and cannot be shared.
- b) only documents in print will be allowed, no electronic devices (such as laptop, tablets or mobile phones).
- c) notes will never get mixed with the exam. During the exercise, notes will be placed at the side, students will be allowed to check them at any moment but will have to let them back to the very place after consulting.
- d) students cannot add to the exam any piece of material previously elaborated.

Students will carry their calculators for the exam, as well as some basic materials for drawing (e.g. a ruler) in order to improve the drawing up of charts.

### Extraordinary Exam Call: Guidelines & Declining to Sit

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

### Compulsory Materials

Materials in the virtual classroom.

### Bibliography

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

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

#### In-depth 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

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

REMARKS
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.

**BIBLIOGRAFÍA (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.
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.
The subject of "Programming Methodology", which is taught after "Basic Programming", complements the latter by adding theoretical elements for algorithm design, emphasising formal specification methods.

- Ability to analyse, design, construct and maintain applications in a robust and secure manner.
- Ability to specify, document, validate and verify programs
- Ability to reason and justify properties related to programs
- Ability 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

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

Assessment of the subject in the ordinary call is done through continuous assessment or final assessment. By defect, all students will do continuous assessment, unless they withdraw from it.

A student may decide to withdraw from continuous assessment to take a final exam. This withdrawal must be presented in writing 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 very 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.

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

Continuous assessment is done through written tests, in which the students should 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
3) Iterations
4) Recursiveness and function calls

Requirements to pass the exam

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:**
A student 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.
- To withdraw from the exam, it is sufficient not to appear on the day. In this case, the grade will be "Not Presented".
- The grade obtained in the written tests under the ordinary call is not maintained.
- Material of the subject (Notes and Laboratories)
- eGela virtual platform of the UPV/EHU for the subject "Programming Methodology"
Guía Docente 2020/21

Centro 163 - Escuela de Ingeniería de Vitoria-Gasteiz
Plan GIIGSI10 - Grado en Ingeniería Informática de Gestión y Sistemas de Información
ASIGNATURA 26017 - Ingeniería del Software
Créditos ECTS: 6

Descripción y Contextualización de la Asignatura

El objetivo general de la asignatura es Diseñar e implementar aplicaciones, cuyos requisitos han sido previamente capturados. Para desarrollar productos software siguiendo un proceso sistemático, se aplicarán metodologías activas y arquitecturas software de varios niveles, apoyándose en herramientas que permiten mejorar la calidad del software.

Para poder cursar Ingeniería del software sin excesiva dificultad se recomienda haber adquirido previamente las siguientes competencias:

- En la asignatura Programación Modular y Orientada a Objetos:
  * Conocer y comprender los fundamentos del paradigma de Orientación a Objetos y los elementos correspondientes en un lenguaje de programación Orientado a Objetos
  * Comprender la diferencia entre clases y objetos; la relación entre clases, la herencia y el polimorfismo
  * Desarrollar pequeños programas aplicando todos los conceptos adquiridos sobre programación
  * Conocimiento y uso de las excepciones como mecanismo de control de errores para el correcto funcionamiento de los programas

- En la asignatura Estructuras de Datos y Algoritmos:
  * Conocimiento y capacidad de aplicar Tipos Abstractos de Datos a problemas de complejidad media: Listas, Pilas, Colas, Tablas Hash, Árboles y Grafos
  * Conocimiento y capacidad de analizar los principales algoritmos de tratamiento de estructuras de datos: Búsqueda, Ordenación, y Enumeración
  * Capacidad de Seleccionar, Diseñar e Implementar de forma eficiente la mejor estructura de datos para la resolución de un problema

COMPETENCIAS / RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Especificas:
C1: Saber distinguir las diversas etapas que componen todo proceso de ingeniería del software.
C2: Saber entender un sistema software con orientación a objetos en el lenguaje UML.
C3: Saber diseñar un sistema software en una arquitectura de varios niveles a partir del análisis.
C4: Saber implementar un sistema a partir del diseño de la aplicación.

Transversales:
C9b: Saber comunicar y transmitir conocimientos, habilidades y destrezas de la profesión de Ingeniero en Informática.

CONTENIDOS TEÓRICO-PRACTICOS

UT1: Introducción a la Ingeniería del Software
  - Motivación y ciclo de vida del software
  - Objetivos, propiedades y tecnologías asociadas.

UT2: Especificación de artefactos UML
  - Estudio de los diferentes artefactos existentes en UML

UT3: Arquitecturas software de varios niveles: Presentación, Logica de Negocio y Datos
  - Diseño y análisis de diferentes capas que componen un sistema software

UT4: Diseño y programación de Software a partir del diseño de la aplicación
  - Diseño y análisis de diferente capas que componen un sistema software

UT5: Implementación de Software a partir de una arquitectura de varios niveles
  - Implementación de software utilizando un conjunto de lenguajes y herramientas actuales

METODOLOGÍA

Al tratarse de una asignatura substancialmente práctica, las clases MAGISTRALES (M) se emplearan para la exposición de los conceptos teóricos necesarios en las clases prácticas, así como para la resolución de dudas que planteen los estudiantes.

Al tratarse de una asignatura substancialmente práctica, las clases MAGISTRALES (M) se emplearán para la exposición de los conceptos teóricos necesarios en las clases prácticas, así como para la resolución de dudas que planteen los estudiantes.
alumnos. De la misma forma, se reforzarán los conceptos adquiridos mediante la resolución de ejercicios, bien individualmente o en grupos reducidos.

Las clases de PRÁCTICAS DE ORDENADOR (GO) se emplearán para aplicar la metodología activa de Aprendizaje Basado en Proyectos. Al principio del cuatrimestre se proporcionará al alumnado el enunciado de un proyecto que aglutine de una forma realista los contenidos de la asignatura. Realizarán este proyecto en grupos de 2-4 personas, siguiendo la metodología ágil SCRUM. Esta metodología plantea desarrollar el proyecto de forma incremental, a través de iteraciones sucesivas, en cada una de las cuales se obtiene un producto parcial que añade nueva funcionalidad al anterior. Cada iteración lleva asociada, además, la realización de su correspondiente documentación.

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<tr>
<th>TIPOS DE DOCENCIA</th>
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<tr>
<td>Tipo de Docencia</td>
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<td>- Sistema de evaluación final</td>
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<th>HERRAMIENTAS Y PORCENTAJES DE CALIFICACIÓN</th>
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<tbody>
<tr>
<td>- Prueba escrita a desarrollar 60%</td>
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<tr>
<td>- Trabajos en equipo (resolución de problemas, diseño de proyectos) 40%</td>
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<table>
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<tr>
<th>CONVOCATORIA ORDINARIA: ORIENTACIONES Y RENUNCIA</th>
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<tbody>
<tr>
<td>La evaluación de la asignatura en la convocatoria ORDINARIA se realizará mediante evaluación continua o evaluación final. Por defecto, todos los estudiantes realizarán la evaluación continua, salvo que renuncien a ella.</td>
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</table>

* EVALUACIÓN MEDIANTE EVALUACIÓN FINAL

El estudiante o la estudiante puede renunciar a la evaluación continua para realizar la evaluación final. Esta renuncia se deberá presentar por escrito al profesorado responsable en los plazos estipulados en el Artículo 18 de la normativa sobre la evaluación del alumnado. No se aceptarán casos excepcionales ni renuncias a la evaluación continua posteriormente a las fechas habilitadas para ello.

Los estudiantes que hayan renunciado a la evaluación continua se someterán a un exámen único por el 100% de la asignatura en la que se evaluarán todos los aspectos trabajados en la asignatura (incluidas las comtencias trabajadas en el proyecto).

* EVALUACIÓN CONTINUA

La evaluación por defecto de la asignatura se hace mediante evaluación continua, salvo que el estudiante o la estudiante haya renunciado expresamente a ella.

La nota final de la asignatura se calcula en base a las notas de los exámenes y de un proyecto a desarrollar en equipo. La nota final se calcula con los siguientes pesos:
- 40% en base a una serie de entregas sobre un proyecto (entregables).
- 60% mediante la realización de distintas pruebas que siempre incluirán 3 exámenes.

En esta evaluación el estudiante realiza tres exámenes a lo largo del cuatrimestre. Las calificaciones obtenidas en los distintos evaluables (exámenes parciales y proyecto) se guardan durante todo el curso, pero no para años siguientes.

El estudiante o la estudiante debe obtener una nota de 4 puntos sobre 10 en cada uno de los exámenes para que se contabilice la práctica. En caso contrario, la calificación obtenida será la media de los exámenes (y en ningún caso será superior a 4 puntos sobre 10).

Si no se puede realizar una evaluación presencial de la asignatura, se realizarán los cambios pertinentes para hacerlo online mediante la utilización de las herramientas informáticas existentes en la UPV/EHU. Las características de esta evaluación online serán hechas públicas.

* RENUNCIA AL DERECHO DE EXAMEN
El estudiante o la estudiante que, habiendo seleccionado realizar la evaluación final, no se presente al examen en la convocatoria ordinaria, obtendrá como calificación final "No Presentado".

El alumnado que sigue la evaluación continua podrá realizar la renuncia a la convocatorio de acuerdo con lo estipulado en el Artículo 12 de la normativa sobre la evaluación del alumnado.

* CASOS DE COPIA:
Se aplicara&amp;#769; el Arti&amp;#769;culo 11 de la normativa vigente referente a la evaluacion&amp;#769;n del alumnado.

### CONVOCATORIA EXTRAORDINARIA: ORIENTACIONES Y RENUNCIA

Los estudiantes que hayan renunciado a la evaluación continua se someterán a un exámen único por el 100% de la asignatura en la que se evaluarán todos los aspectos trabajados en la asignatura (incluidas las comtencias trabajadas en el proyecto).

El resto de estudiantes serán evaluados mediante un examen que supone el 60% de la nota final y la parte correspondiente al proyecto (40% de la nota final). Aquellos estudiantes que no hubieran aprobado realizarán un examen de esta parte.

El estudiante o la estudiante debe obtener una nota media de al menos 4 sobre 10 en el aparte correspondiente al examen para que se contabilice la práctica. En caso contrario, la calificación obtenida será la nota del examen.

Para renunciar al derecho al examen bastará&amp;#769; con no presentarse.

Si no se puede realizar una evaluación presencial de la asignatura, se realizarán los cambios pertinentes para hacerlo online mediante la utilización de las herramientas informáticas existentes en la UPV/EHU. Las características de esta evaluación online serán hechas públicas.

* CASOS DE COPIA:
Se aplicara&amp;#769; el Arti&amp;#769;culo 11 de la normativa vigente referente a la evaluacion&amp;#769;n del alumnado.

### MATERIALES DE USO OBLIGATORIO

Apuntes de la asignatura accesibles a través de la plataforma egela.

### BIBLIOGRAFÍA

**Bibliografía básica**

- Design Patterns, Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, John M. Vlissides, 1995
- Java 8 in Action

**Bibliografía de profundización**


**Revistas**

- Direcciones de internet de interés

http://www.uml.org/
- Sitio oficial de UML donde se puede encontrar su especificación y documentación complementaria.
http://www.visual-paradigm.com/product/vpuml/
Sitio oficial de la herramienta Visual Paradigm.

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

**OBSERVACIONES**

Para esta asignatura son requisito los conceptos abordados en las asignaturas Programación Modular y Orientación a Objetos y Estructuras de Datos y Algoritmos. Para cursar está asignatura, se debería haber aprobado o al menos cursado dichas asignaturas.
### Centre
University College of Engineering of Vitoria-Gasteiz

### 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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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

4. Sistemas Expertos y Modelos de Redes Probabilísticas, Enrique Castillo y otros, Universidad de Cantabria.

Journals

1. Decision Support Systems
2. IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE
3. International Journal of Neural Systems
4. IEEE Computational Intelligence Magazine
5. JOURNAL OF MACHINE LEARNING RESEARCH

Websites

1. http://dssresources.com
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>
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<tr>
<th>Face-to-Face Teaching Hours</th>
<th>Lectures</th>
<th>Seminars</th>
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</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/
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<tr>
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<th>University College of Engineering of Vitoria-Gasteiz</th>
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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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<tr>
<th>Face-to-Face Teaching Hours</th>
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### Assessment System

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

#### Clarification regarding assessment

### Bibliography

#### Basic Bibliography

#### In-depth Bibliography

#### Websites
<table>
<thead>
<tr>
<th>COURSE GUIDE</th>
<th>2020/21</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Faculty</strong></td>
<td>163 - Faculty of Engineering - Vitoria-Gasteiz</td>
</tr>
<tr>
<td><strong>Degree</strong></td>
<td>GIEIAU10 - Bachelor's Degree in Industrial Electronics and Automation Engine</td>
</tr>
</tbody>
</table>

| COURSE | 25996 - Digital Electronic Systems | **Credits, ECTS:** | 6 |

<table>
<thead>
<tr>
<th>COURSE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following competencies from the degree verified report will be developed: C3 – Knowledge on basic and technologic topics, which will allow learning new methods and theories providing versatility to adapt themselves to new situations. C4 – Capability to solve problems with initiative, decision-making, creativity, critic thinking and to convey and transmit knowledge and skills in engineering fields. C6 – Capability to handle specifications, regulations and rules of mandatory compliance. C10 – Capability to work in a multidisciplinary and multilingual environment TEEOI3 – 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</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COURSE CONTENTS, THEORETICAL &amp; APPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>8051 based architecture</td>
</tr>
<tr>
<td>Data and code memory</td>
</tr>
<tr>
<td>Interrupts and integrated peripherals</td>
</tr>
<tr>
<td>8051 assembly language</td>
</tr>
<tr>
<td>Asynchronous communications: RS-232 and RS-485</td>
</tr>
<tr>
<td>Synchronous protocols: I2C and SPI</td>
</tr>
<tr>
<td>I/O peripherals: LCDs, Key arrays</td>
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<tr>
<td>Voltage supervisor and watchdogs</td>
</tr>
<tr>
<td>Other architectures</td>
</tr>
<tr>
<td>The following demonstrations will be carried out: IDE and code generation Simulation/debugging Functions and loops GPIO8#8217;s Audio generation Stepper motor Serial port Alphanumeric LCD I2C LED driver 4x4 key array read IDEs for other architectures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>
**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>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of face-to-face teaching</td>
<td>45</td>
<td>15</td>
<td></td>
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<tr>
<td>Hours of student work outside the classroom</td>
<td>67.5</td>
<td>22.5</td>
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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 and percentages of final mark**

- Continuous evaluation
- End-of-course evaluation

- 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 fulfillment (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.

**BIBLIOGRAPHY**

**Basic bibliography**

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

**Detailed bibliography**

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

**Journals**

**Web sites of interest**

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.
Descripción y Contextualización de la Asignatura

Industrial Automation is a cornerstone of the Automotive Industry, in terms of improvement of productivity, innovation and continuous improvement. This subject is focus on the integration of the different automation pyramid levels through the implementation of communication systems, which are regularly used in the industry.

Competencias/ Resultados de aprendizaje de la asignatura

Being elective, this subject improves the competence acquisition related to this grade. Concretely, the knowledge based on computer tools and their application in manufacturing process and Industrial Automation.

As a result of this learning, the student are expected to:

Handle the different software applications integrated in an Industrial Automation Project,

Acquire expertise in the Industrial Communications Standards available to connect this pool of applications,

Gain competence to deal with complex Automation Projects and process of Digital Integration in the Automotive Industry.

Contenidos teórico-prácticos

Communication Systems in the Automation Pyramid.
High-Level Language Programming with automata.
OPC Communication Protocol.
Industrial Process Simulation in SIMIT as OPC Client.
MQTT network Protocol.
MQTT in Industrial Automation.
Web Servers in automation environment.

Metodología

Master lectures cover theoretical concepts in a practical way, through examples and tutoring in the use of the software included in this course.
In the laboratory, students develop examples and projects in order to practice the acquired skills.

**Sistemas de evaluación**

There are two different assessment systems: Continuous Evaluation and Final Evaluation.

**Convocatoria Ordinaria: Orientaciones y Renuncia**

The main assessment system is the Continuous Evaluation, which uses the following instruments:

- Multiple Choice Test: 30%
- Practical tasks (Exercises, problems): 35%
- Teamwork (projects): 35%

The final evaluation, as alternative way, consists in a theoretical exam (70%) and a practical exam (30%). Passing both part is compulsory.

**Convocatoria Extraordinaria: Orientaciones y Renuncia**

According to the University Regulations, in this case, only a Final Evaluation format can be taken in this case.

**Materiales de uso obligatorio**

Considering the high technological aspects of this subject and its changing nature, the teaching team will provide the compulsory material, in case it was necessary.

**Bibliografía**

Likewise, there is not an updated and steady Reference Bibliography. That being the case, the teachers will train students to use academic research methodologies and achieve their own Reference Bibliography, which best suits to their future professional career.
Centre | University College of Engineering of Vitoria-Gasteiz
Name of subject | 26050 – Hydraulic Facilities and Machines
Qualification | Degree in Mechanical Engineering
Type | Compulsory
Credits | 6 ECTS
Year | 3
Term(s) | 2nd
Department | Nuclear Engineering and Fluid Mechanics
Language | Spanish and Basque

Outcomes / Objectives

Hydraulic pump project, network operation and regulation. Project on different types of water turbines. Hydroelectric power stations.

Syllabus

Hydraulic turbomachines: overview and fundamental principles. Hydraulic machines and the main parts of a turbomachine are studied and classified, including forms of representation and velocity triangles. Nomenclature for heights, flow rates, power, losses and efficiency is also included, for both pumps and turbines. The subject also studies the application of the fundamental theorem of turbomachinery or Euler's theorem to turbines and pumps, as well as the different applications of hydraulic turbomachinery. Similarities and dimensional analysis applied to turbomachinery. The similarities and analogies required between two turbomachines in order for a transfer of their respective behaviours to occur are analysed. The Buckingham theorem is used to determine the most important dimensionless parameters in turbomachinery, analysing the fundamental theorem of Combes-Bertrand-Rateau. The concept of specific speed is introduced and examples of homologous turbomachines presented. Water turbopumps. The elements, construction types, characteristic curves, regulations and operation of turbopumps are studied. Positive displacement machines. The different types of positive displacement machines are studied, including their elements, form of operation and characteristic curves. Pumping stations. The calculation and construction details of simple, compound and high pressure pump stations. Fans and ventilation facilities. The elements, construction types, characteristic curves, regulation and operation of fans are analysed, as well as their application to ventilation facilities. Hydroelectric power stations. The layout of hydroelectric power stations is described, and the types of waterfalls to consider are analysed, along with hydroelectric power plant types and main parts. A river flow rate calculation problem is also studied, as well as the different types of characteristic curves and regulation systems. Water turbines. The elements, construction types, characteristic curves, regulation and operation of water turbines are analysed. Wind farms. The general theory of wind turbines and Betz's law is explained, and the different types of available wind turbines described. Water supply and sanitary sewer networks. The collection, regulation, transport and distribution of water is studied, as well as the collection and distribution of wastewater.
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>
<th>Industrial workshops</th>
<th>Field practice</th>
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<td>48</td>
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</table>

Student Hours of Non Face-To-Face Activities

<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>
<th>Industrial workshops</th>
<th>Field practice</th>
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<td>72</td>
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</tr>
</tbody>
</table>

Compulsory materials

Department’s notes. Set of department’s problems. Outline of laboratory practicals.

Bibliography

Basic Bibliography

- Turbomáquinas hidráulicas. Claudio Mataix. Editorial ICAI. 1975.-
- Nuevo manual de instalaciones de fontanería y saneamiento (adaptado al Código Técnico de la Edificación). Franco Martín Sánchez. AMV ediciones. 2008

In-depth Bibliography


Magazines

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

Websites

- Hydraulic Institute. www.pumps.org
- Pump-Flo Co. www.pump-flo.com/manulist.asp
- Animated software company, www(animatedsoftware.com
- www.pump-zone.com
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>
<thead>
<tr>
<th>TYPE OF TEACHING</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
<th>TI</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of in-person teaching</td>
<td>42</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>12</td>
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<tr>
<td>Hours of no in-person teaching for students</td>
<td>63</td>
<td>9</td>
<td>15</td>
<td></td>
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<td>18</td>
</tr>
</tbody>
</table>

*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

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

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

In case of not passing the subject, the works of the field practices are saved 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/
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**

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
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<tbody>
<tr>
<td>Hours of face-to-face teaching</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Hours of student work outside the classroom</td>
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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 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%)
5. Realization of other individual tasks (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
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.
**Centre**: University College of Engineering of Vitoria-Gasteiz

**Name of subject**: 26030 – Database Administration

**Qualification**: Degree in Computer Management and Information Systems Engineering

**Type**: Compulsory

**Credits**: 6 ECTS

**Year**: 3

**Term(s)**: 2nd

**Department**: Computer Languages and Systems

**Language**: Spanish

---

**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

<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>
<th>Industrial workshops</th>
<th>Field practice</th>
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</thead>
<tbody>
<tr>
<td>40</td>
<td>20</td>
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</table>

Student Hours of Non Face-To-Face Activities

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Seminars</th>
<th>Classroom practice</th>
<th>Lab. practice</th>
<th>Computer sessions</th>
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<td>40</td>
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</table>

Assessment System

General criteria

→ Written essay exam
→ Practical tasks (exercises, case studies o 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** 2020/21

<table>
<thead>
<tr>
<th>Faculty</th>
<th>163 - Faculty of Engineering - Vitoria-Gasteiz</th>
<th>Cycle</th>
<th>Not Applicable</th>
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<tbody>
<tr>
<td>Degree</td>
<td>GMECAN10 - Bachelor’s Degree in Mechanical Engineering</td>
<td>Year</td>
<td>Second year</td>
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**COURSE**

<table>
<thead>
<tr>
<th>COURSE DESCRIPTION</th>
<th>Credits, ECTS:</th>
<th>6</th>
</tr>
</thead>
</table>

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.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

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
COURSE CONTENTS, THEORETICAL & APPLIED

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.

TEACHING METHODS
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

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of face-to-face teaching</td>
<td>45</td>
<td></td>
<td>15</td>
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<tr>
<td>Hours of student work outside the classroom</td>
<td>67.5</td>
<td>22.5</td>
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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 30%
- Exercises, cases or problem sets 35%
- Teamwork assignments (problem solving, Project design) 30%
- Oral presentation of assigned tasks, Reading 5%

### 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
**BIBLIOGRAPHY**

**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.


**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
- Tecnología del agua

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.
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.

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.

Types of teaching
- Structural analysis. The matrix method.
- Linear and non-linear analysis, application examples.
- Finite elements in dynamics. Modal analysis, theory of vibrations.

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.

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
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.

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.

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.
METODOLOGIA (INGLÉS)

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.

CONVOCATORIA ORDINARIA: ORIENTACIONES Y RENUNCIA (INGLÉS)

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.

CONVOCATORIA EXTRAORDINARIA: ORIENTACIONES (INGLÉS)

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.

MATERIALES DE USO OBLIGATORIO (INGLÉS)

Theory and problems explained during lectures.

BIBLIOGRAFIA (INGLÉS)

- 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
- MELERO, J. Resistencia de Materiales. Editorial: UPV-EHU