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

### English Friendly Courses taught in SPANISH:

<table>
<thead>
<tr>
<th>COURSE</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor's Degree in Informatics Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26236 Administración Sistemas y Redes</td>
<td>Sep. 2021- Jan. 2022</td>
<td>6</td>
<td>M</td>
</tr>
<tr>
<td>26248 Diseño y Construcción de Sistemas Digitales</td>
<td>Sep. 2021- Jan. 2022</td>
<td>6</td>
<td>M</td>
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<tr>
<td>26238 Interacción Persona Computador</td>
<td>Sep. 2021- Jan. 2022</td>
<td>6</td>
<td>M</td>
</tr>
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<td>Sep. 2021- Jan. 2022</td>
<td>6</td>
<td>M</td>
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<tr>
<td>26213 Modelos Abstractos de Cómputo</td>
<td>Sep. 2021- Jan. 2022</td>
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<tr>
<td>26026 Diseño de Bases de Datos</td>
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<td>26217 Gráficos por Computador</td>
<td>Sep. 2021- Jan. 2022</td>
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<td>26218 Minería de datos</td>
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<td>6</td>
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<td>26025 Sistemas de Gestión de Seguridad de Sistemas de Información</td>
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1 SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30.  
By clicking the subject’s name, its Syllabus will appear.
Bachelor's Degree in Artificial Intelligence

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
<th>Semester</th>
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<tr>
<td>26269</td>
<td>Razonamiento Automático</td>
<td>Jan. 2022- May 2022</td>
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English Friendly Courses taught in BASQUE:

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<th>Semester</th>
<th>Credits</th>
<th>Schedule</th>
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<td>Sep. 2021- Jan. 2022</td>
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<td>26269</td>
<td>Arrazoibide Automatikoa</td>
<td>Jan. 2022- May 2022</td>
<td>6</td>
<td>M</td>
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</table>

2 SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30.
By clicking the subject’s name, its Syllabus will appear.
COURSE GUIDE 2021/22

<table>
<thead>
<tr>
<th>Faculty</th>
<th>226 - Faculty of Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree</td>
<td>GINFOR20 - Bachelor's Degree in Informatics Engineering</td>
</tr>
<tr>
<td>Cycle</td>
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</tr>
<tr>
<td>Year</td>
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</tbody>
</table>

COURSE

26236 - System & Network Administration  Credits, ECTS: 6

COURSE DESCRIPTION

This subject aims to present and develop the main aspects associated with the administration of information systems. An approach will be followed not only oriented to the functions of the administrator, but also to the user who makes use of this type of systems.

In the first part of the subject, the administration of an autonomous system is introduced, with special emphasis on managing the use of resources (processor, memory, disk) by users and processes of the system. In the second part of the subject, the design, start-up and implementation of network services is studied. Security is a key issue in current systems and it is considered transversely along the entire subject.

The concepts are presented in a practical way, since the student administers his own system, beginning with managing an independent system in the first part of the subject and continuing later in the second part with the administration of different services in a system composed of several servers.

For a proper work on this subject, it is highly recommended to have passed the subjects of 'Introduction to Operating Systems' and 'Introduction to Computer Networks', both subjects of the 2nd year of the degree.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The following skills associated with the common computing branch are developed in the subject:

- Knowledge, administration and maintenance of computer systems, services and applications.
- Knowledge of the characteristics, functionalities and structure of the Operating Systems to design and implement applications based on their services.
- Knowledge and application of the characteristics, functionalities and structure of Distributed Systems, Computer Networks and the Internet and design and implement applications based on them.

In particular, it is also intended to work on the following skills related to the Computer Engineering specialty:

- Be able to design and implement system and communication software.
- Be able to understand, apply and manage the guarantee and security of computer systems.
- Be able to design, deploy, administer and manage computer networks.

CONTENIDOS TEÓRICO-PRÁCTICOS

Unit 1. Introduction.
Unit 2. Introduction to Scripting.
Unit 3. Resource management.
Unit 4. Start and stop of the system.
Unit 5. Basic security aspects.
Unit 6. Network configuration.
Unit 7. Local network services.
Unit 8. Internet / Intranet services.
Unit 9. Design, configuration and implementation of a network service.

TEACHING METHODS

In this subject several activities are contemplated, based mainly on the so-called active methodologies:

- Master classes
- Laboratories and their monitoring
- Project work of the subject
### TYPES OF TEACHING

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

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

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

### Evaluation tools and percentages of final mark

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

Two evaluation modalities are contemplated: joint (or final) and continuous. Each student will be able to choose the one that they think best suits their preferences / circumstances.

**Continuous evaluation**

The continuous evaluation is voluntary. It must be explicitly requested by the student and implies that it is committed to the associated assessment mode.

The activities considered in this evaluation mode are described below, along with their weight in the final grade.

<table>
<thead>
<tr>
<th>Weight</th>
<th>Test</th>
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<tbody>
<tr>
<td>15-25%</td>
<td>Performing face-to-face activities</td>
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<tr>
<td>50-60%</td>
<td>Written tests associated with the continuous monitoring</td>
</tr>
<tr>
<td>20-30%</td>
<td>Project and its public presentation</td>
</tr>
</tbody>
</table>

**Joint evaluation**

The joint evaluation is the evaluation that is assumed by default for each student and consists of two tests:

<table>
<thead>
<tr>
<th>Weight</th>
<th>Test</th>
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<tbody>
<tr>
<td>80%</td>
<td>Final exam in official call (January or June)</td>
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<tr>
<td>20%</td>
<td>Project (15%) and its presentation (5%)</td>
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</table>

In both cases, all activities are mandatory. To obtain at least the pass grade, it is necessary to obtain at least a rating of 4 out of 10 in each of the activities and an average rating of 5 or above.

The project must be delivered to the teachers on the dates indicated in the student guide. The evaluation will be completed through interviews with teachers.

**NOTE:** In the event that confinement is re-established due to COVID-19, the evaluation tests (both continuous and final evaluation) will be carried out electronically through eGela questionnaires or deliveries and interviews using the connection via BBC.

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation model is the same as the overall evaluation, and consists of two tests:

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<th>Weight</th>
<th>Test</th>
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</table>
80% Final exam in official call (January or June)
20% Project (15%) and its presentation (5%)

Both activities are mandatory. To obtain at least the pass grade, it is necessary to obtain at least a rating of 4 out of 10 in each of them and an average rating of 5 or above.

The project must be delivered to the teachers at least one week before the date set for the exam. Your evaluation will be completed through an interview with the teachers.

NOTE: In the event that confinement is re-established due to COVID-19, the evaluation tests (both continuous and final evaluation) will be carried out electronically through eGela questionnaires or deliveries and interviews using the connection via BBC.

### MANDATORY MATERIALS

- Página eGela de la asignatura
- Máquinas virtuales de la asignatura

### BIBLIOGRAFÍA

#### Basic bibliography

- Provided subject material (available through https://egela.ehu.es):
  - Script of the laboratory notebook
  - Introductory notes to Scripting

#### Detailed bibliography

- S. Lakshman: Linux Shell Scripting Cookbook, 2011.

#### Journals

- Ubuntu server guide (11.10).

-30 best sources for linux / bsd / unix documentation on the web.

- http://diariolinux.com

OBSERVATIONS
COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics
Degree GINFOR20 - Bachelor's Degree in Informatics Engineering
Cycle Not Applicable
Year Not Applicable

COURSE

26248 - Design & Implementation of Digital Systems
Credits, ECTS: 6

COURSE DESCRIPTION

This is a compulsory 3rd year-1st semester subject for the Computer Engineering specialty in the 4-year degree in IT Engineering, and an optional subject for the rest of the specialties.

It is the continuation of the subject "Design Principles of Digital Systems" in the 1st year, and complements the "Design of Embedded Systems" subject.

The main objective is to learn to design digital systems of average complexity based on a structured methodology.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Once this subject has been completed, students will be able to face the design and implementation of a medium complexity digital system, being able to:

1. Design digital systems of medium complexity and different purposes.
2. Use a structured methodology in the design of digital systems.
3. Learn about and analyse alternative implementations of digital systems.
4. Identify the phases of the process of design of digital systems and analyse the most commonly used tools.
5. Describe a digital system through VHDL language.
6. Edit and simulate a design through CAD tools.
7. Build and verify a prototype of a design using a programmable device (PLD).

CONTENIDOS TEÓRICO-PRÁCTICOS

Topic 1: Introduction: Historical evolution.
Topic 2: Methodology of design of digital systems.
Topic 3: Examples of design.
Topic 4: Hardware description languages: introduction to VHDL.
Topic 5: Programmable Logical Devices.
Topic 6: Design and tools cycle.

TEACHING METHODS

"PBL: Project Based Learning" teaching methodology is used, with the student applying different active and cooperative learning techniques. The concepts are learned by carrying out projects in groups in a coordinated manner, gradually applying the acquired knowledge.

On one hand, the aim is to give the student suitable training for insertion in the labour market (in our case, in engineering companies) and, on the other, focus the teaching model on student learning rather than teaching.

In this subject students will develop a project presented on the first day of class, covering the entire subject (100%) and working in groups of 2-3 students.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Hours of face-to-face teaching</th>
<th>M</th>
<th>S</th>
<th>GB</th>
<th>GL</th>
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<tbody>
<tr>
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<td>15</td>
<td>25</td>
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Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
The student may opt for Continuous assessment or Final assessment.

1) CONTINUOUS ASSESSMENT:
It is compulsory to attend 80% of the lessons, where students work in groups to develop the proposed project.
Assessment percentages:
- 30%, Knowledge exam (individual assessment). The student must pass, and if he/she fails there is a second opportunity at the end of the term.
- 15%, file or portfolio (group assessment): Electronic files accessible to the group members and to the professor, which the students update throughout the year.
- 45%, Project report, construction and demonstration of the prototype (group assessment).
- 10%, Presentation of the project (individual assessment).

2) FINAL ASSESSMENT:
- 50%: Exam on the basic concepts associated with the subject.
- 50%: Creation of a design with its basic phases. The report and prototype must be handed in before the exam. An interview will also take place.

In this case, the students will contact the professors IN THE FIRST MONTH OF THE SUBJECT to know due-dates.

To pass the subject, in any type of assessment, it is necessary to score at least a 4 out of 10 in each of the parts independently, and the final weighted grade has to be greater than or equal to 5. If in any of the parts the required minimum grade of 4/10 is not achieved, a final grade of NO-PASS will be given.

NOTE: In case of a new lockdown, the assessment (both continuous and final) will be carried out electronically through questionnaires, interviews and or deliverables of eGela and through a BBC connection.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

It will be FINAL ASSESSMENT type:
- 50%: Exam on the basic concepts associated with the subject.
- 50%: Creation of a design with its basic phases. The report and prototype must be handed in before the exam. An interview will also take place.

The students in this situation must contact the professors IN THE FIRST MONTH OF THE SECOND TERM to know due-dates.

More detailed information is available in the Student's Guide (eGela website for the subject).

To pass the subject, it is necessary to score at least a 4 out of 10 in each of the parts independently, and the final weighted grade has to be greater than or equal to 5. If in any of the parts the required minimum grade of 4/10 is not achieved, a final grade of NO-PASS will be given.

NOTE: In case of a new lockdown, the assessment will be carried out electronically through questionnaires, interviews and or deliverables of eGela and through a BBC connection.

MANDATORY MATERIALS

- Computer.
- EDA Tools and prototyping platform based on PLDs.

BIBLIOGRAFIA

Basic bibliography
Detailed bibliography

- ¿Diseño de Sistemas Digitales con VHDL¿, Pérez S. A., Soto E., Fernández S., Thomson, 2002
- ¿Dispositivos lógicos programables y sus aplicaciones¿, Mandado E., Alvarez L.J., Valdés M.D., Thompson, 2003
- ¿Síntesis de Circuitos Digitales, un enfoque algorítmico¿, Deschamps J.P., Thompson, 2002

Journals
- IEEE Transactions on Industrial Electronics
- IEEE Transactions on Consumer Electronics
- IEEE Transactions on Control Systems Technology

Web sites of interest

http://users.ece.gatech.edu/~hamblen/book/bookse.htm

(¿Rapid prototyping of digital systems¿, Hamblen)

http://www.ddpp.com/ (¿Digital design: principles and practices¿, Wakerly)

http://www.dte.uvigo.es/vhdl/ (¿Diseño de Sistemas Digitales con VHDL¿, Pérez)

http://www.asic-world.com

http://www.altera.com/

http://www.xilinx.com/

http://www.cadence.com/

http://www.mentor.com/

http://www.synopsys.com/

OBSERVATIONS
The "Human-Computer Interaction" subject is compulsory for students in the Software Engineering speciality in the Computer Science degree course, and optional for students of other specialities. You will need to have basic knowledge of Software Engineering, for example what a three-level architecture is or a software development cycle. During the term, the front end of a three-level web application will be developed.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The subject aims at the student learning to: (1) analyse (apprehend/understand), discuss, evaluate and analyse user requirements in order to (2) analyse, design and evaluation systems that are usable, accessible and ergonomic in different environments and places in a structured and methodical way, (3) paying special attention to the different needs of different types of users with varying cognitive and psycho-motor (dis)abilities, (4) transmit and weigh up, in a collaborative manner with users, ideas, designs and applications for these systems.

In addition, we will work on other generic competences envisaged in the profile of the degree, in the document List_of_competences.pdf at http://www.ehu.es/documents/340468/516505/Lista+de+competencias.pdf, in particular the general competences : C3, C4, C5, C9 and C10 of the degree, as well as the specific competences IS1, IS2 and IS4 of the specialty of Software Ingeneering.

CONTENIDOS TEÓRICO-PRACTICOS

Theme 1 Introduction. Basic concepts.
Theme 2 The human factor.
Theme 3 Devices for, and styles of, interaction.
Theme 6 Design techniques. New trends.
Theme 7 Interface evaluation techniques. Carry out a usability study. Measurements and analysis.

TEACHING METHODS

The subject involves three main types of activities, all based on presence-based classes (one-off and regular) and student participation: theory classes, practical sessions in the laboratory and other sessions for work and discussion in groups.

Based on active teaching methodologies, both in the theory classes and in the practical sessions, and with the aim of encouraging students to participate actively and gain satisfaction, activities based on teamwork and the presentation of solutions will be organised, followed by debates and the discussion of problems encountered in the practical work sessions.

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Types of teaching</th>
<th>M</th>
<th>S</th>
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<tbody>
<tr>
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Evaluation methods
- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Se especifican a continuación en función del tipo de evaluación 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The assessment system for the subject offers two options: continuous assessment or exam and practical work -based assessment (final assessment).
1. Continuous assessment: based on one-off and regular attendance in class, presenting results, taking tests on the knowledge acquired and the performance of practical work (both individually and in groups). The grade is obtained from the following assessment results:
a. Development project (75% of the grade, compulsory): a project on the construction of a usable interface, throughout the term. Individual tests on the knowledge acquired will be set, and the mark will help towards the end-of-project grade.
b. Complementary work (25% of the grade): An evaluation of the summaries made from the course reading list and presentation of solutions, as well as participation in related debates.

2. Exam and practical work based-assessment (final assessment). Based on the established periods and procedures, with voluntary attendance in class. The final exam consists of two phases: one to assess the competences obtained in the course of the usable interface project (compulsory and done before the exam), and the other to assesses the level of knowledge shown in the subject. Both the practical work and the exam are individual and compulsory, and must be passed (with a mark of 5 for each one).

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The same requirements and assessment criteria as for the final assessment are applied. Pass grades are not carried over to the next year.

MANDATORY MATERIALS

Materials provided by the professor (notes, slides, definitions, articles, studies,...).

BIBLIOGRAFÍA

Basic bibliography
- Usability Engineering. Jakob Nielsen, AP Professional, 1993

Detailed bibliography

Journals

Web sites of interest
- http://hcibib.org/
- http://www.useit.com/
- http://www.uie.com/articles/
- http://www.usernomics.com/

OBSERVATIONS
COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics
Degree GINFO20 - Bachelor's Degree in Informatics Engineering
Cycle Not Applicable
Year Third year

COURSE
26210 - Network Services & Applications
Credits, ECTS: 6

COURSE DESCRIPTION
This subject is taken in the third year, when the student must opt for one of the specialities. Anyway, this subject is compulsory for all students. Due to the importance that computer networks - especially the Internet - have nowadays, it is considered that all students should acquire basic knowledge about this area.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
In this subject, the basic requirements for developing applications in which the network plays a key role are studied. The subject focuses on the part of application development that is linked to the existence of the Internet, giving special importance to the study of developments in TCP/IP and, specifically, web applications. Models for the creation of network applications and interfaces for their development are studied.

CONTENIDOS TEÓRICO-PRACTICOS
1 Design of network applications.
2 Interfaces for access to network services: sockets.
3 Web-based applications.
4 Advanced tools for the development of network applications.

TEACHING METHODS
Being basically a practical subject, in the theoretical classes the main concepts are explained and the student then goes into greater depth following the references provided by the professor. Theoretical concepts are put into practice in the practical classes.

Students have to carry out two types of practical work in groups. 1) They do the practical work proposed in the laboratory classes, always supported by the professor. This practical component uses to be short (one session) and highly directed, without much margin for moving away from the objective.
2) Students have to carry out (mainly out of classroom) other more general practical work, using the main concepts taught in class in a wider and more realistic way. The content of the practical work should be agreed with the professor beforehand. Specifically, the students have to perform one of these practical projects associated to each of the 3 first themes.

TYPES OF TEACHING

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Legend: M: Lecture-based
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GCA: Applied fieldwork groups

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

Evaluation tools and percentages of final mark
- Ehunekoak eta ebaluazio motak hurrengo ataletan zehazten dira. 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT
Students have to choose between two types of evaluation: continuous or overall. In both cases, the weight of each theme in the syllabus is the same: 10%, 45%, 40% and 5%.
Initially, any student attending class is considered as enrolled in continuous evaluation.
Their pre-enrolment becomes definitive after the confirmation of the application by the student within the established timescale (between 60% and 80% of the course). If, within these dates, the student does not confirm his/her enrolment in continuous evaluation it is understood that he/she opts out of it.

In continuous evaluation, attendance at class is compulsory. In this case, the evaluation is divided into three parts. On one hand, students do practical work in groups in the 3 first themes, mainly outside class hours. These represent 50% of the mark (10%, 20% and 20%). On the other hand, in themes 2 and 3 the student takes a written exam (multiple-choice), which represents 45% of the final mark (25% and 20%). It is necessary a mark of 3 in each exam to stay in continuous evaluation. Finally, in the last theme the practical work done in the laboratory is evaluated. It represents 5% in the final
EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the case of overall evaluation, the student has to hand in a number of practical projects (done outside class hours) on an individual basis, and agreed with the professor. He/she also has to take a written exam that represents 70% of the final mark.

MANDATORY MATERIALS

https://egela.ehu.eus/

BIBLIOGRAFÍA

Basic bibliography
- TCP/IP Sareak, 3. argitaldia. JM Rivadeneyra. UEU 2009

Detailed bibliography

Journals

Web sites of interest
W3 Consortium: http://www.w3.org/
The Open Web Application Security Project: http://www.owasp.org/
Complemento a la bibliografía básica: http://www.tcpipguide.com/free/t_toc.htm

OBSERVATIONS
The main objective of "Abstract Computation Models" subject is to determine the computational difficulty of those problems that can be solved by a computer. This subject presents theoretical contents to distinguish whether a given problem is very difficult to compute or not. Moreover, we will see that there exist problems that cannot be solved by any computer. "Abstract computation models" subject complements the knowledge of the previous "Languages, Computation and Intelligent Systems" subject.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

- Know basic Computability Theory concepts
- Be able to formalize Computability Theory concepts
- Realize that there are limits beyond which algorithmic methods do not work
- Develop intuition about non computable and intractable problems
- Know some Complexity classes and the relationship among them
- Learn techniques for determining the computational difficulty of problems

CONTENIDOS TEÓRICO-PRÁCTICOS

- Techniques to deal with intractable problems. Aproximations. Randomness.
- Limits of computation. More about undecidable problems.

TEACHING METHODS

Support material will be available in the eGela virtual classroom.

We will work with Python programming language in the laboratories.

TYPES OF TEACHING

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Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 80%
- Exercises, cases or problem sets 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The subject has two different kinds of assessments: final (or overall) assessment and continuous assessment.

Continuous assessment

The student will voluntarily decide whether to take part or not in it, since it is offered exclusively for those students who can carry out continuous monitoring of the subject within the established dedication framework and can attend to presentational activities.

Pre-enrolment in the continuous assessment mode will take place during the first week of the course. Pre-enrolment will
become definitive after confirmation of the application by the student on established dates (around the 12th week of the course, with approximately 70% of the continuous assessment already completed) and after partial performance verification by the teaching staff. If the student does not confirm his or her definitive enrolment in the continuous assessment on the abovementioned dates, it will be understood that he or she dismisses the enrolment.

The course is mainly focused on continuous assessment.

Continuous assessment will be evaluated by means of three written exams, with a weight of 30, 40 and 20% of the overall grade of the subject. Besides, a 10% of the grade will be determined by laboratory work.

Additionally, a minimum of a 30% grade must be achieved in each written exam and a minimum of 5 over 10 is required to pass the subject.

Final Assessment

This kind of assessment will be applicable to students who do not wish to take part in continuous assessment or those who do not meet the criteria continuous assessment.

In this case, a single written exam about the 100% of the subject must be performed. It will be carried out according to the official examination schedule of the Faculty. The minimum grade required in the final exam will be 5 out of 10.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

One single written exam about 100% of the subject in which the minimum grade is 5 out of 10.

MANDATORY MATERIALS

BIBLIOGRAFÍA

Basic bibliography

John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman. "Introducción a la teoría de Autómatas, Lenguajes y Computación: 2ª edición". Pearson educación, 2002


Detailed bibliography


J. IBAÑEZ; A. IRASTORZA; A. SANCHEZ. "LOS PROGRAMAS WHILE. Bases para una teoría de la Computabilidad". Informe interno. UPV/EHU / LSI / TR 5-96.


Journals

Web sites of interest

http://www.jflap.org/

https://eu.udacity.com/course/intro-to-theoretical-computer-science--cs313

COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics
Degree GINFOR20 - Bachelor's Degree in Informatics Engineering

COURSE
26026 - Database Design
Credits, ECTS: 6

COURSE DESCRIPTION
The subject Database Design is located in the Software Engineering specialty of the degree in Computer Engineering. This subject is based on knowledge acquired in the subject called Databases that is taught in the second year, and also addresses issues of interest for the optional subject Databases Administration. It also establishes links with some aspects described in the Software Engineering subject, specifically at the data management level of the three-layer architectures.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
In this subject, after successfully completing the objectives indicated below, the following competences will be acquired:

* The ability to evaluate the customer's needs and specify the software resources required to satisfy these needs, reconciling conflicting objectives through the search for acceptable compromises within the limitations of cost, time and the existence of already-developed systems and from the organizations themselves.

* The ability to identify and analyse problems and design, develop, implement, test and document software solutions based on knowledge of current theories, models and techniques.

Other general competences will also be worked on. These are described in the course profile in the document titled 'Lista_de_competencias.pdf', which is available at http://www.ehu.es/documents/340468/516505/Lista+de+competencias.pdf, in particular the general competences of the course C3, C4, C6, C8 and C9, as well as those of the Software Engineering speciality IS1, IS2, IS3 and IS4. And finally, transversal competences such as teamwork, oral and written communication, innovation, creativity and entrepreneurship, and autonomous learning.

Objectives

* Learn about the design phases of a database.

* Analyse data requirements to design conceptual schemes using E/R, E/R+ and UML.

* Design a logical schema (using a relational data model) of a database based on the conceptual schema.

* Normalise the relational schema.

* Define views over the relational schema.

* Define integrity constraints over the relational schema.

* Carry out the physical design of a database.

* Learn about other design techniques:
  ** Data Warehouses.
  ** Distributed databases.

CONTENIDOS TEÓRICO-PRÁCTICOS
1. Introduction: Principles of Databases Design, Life cycle of a DBS(Data Base System), design steps.
2. Conceptual Design: ER and UML models
   ER model
   ER+ model
   Transformation from ER to Relational
   Representation of conceptual design on UML
3. Normalization Process
4. SQL views
5. Integrity Constraints
6. Physical design
7. Other design techniques
Distributed Databases
Data Warehouses.

TEACHING METHODS

Most of the syllabus will be covered during teaching hours called classroom hours. Students will also have to strengthen their knowledge of concepts by working autonomously outside class hours (i.e. non-teaching hours), consulting specialised bibliography and doing project work and exercises.

In teaching and laboratory hours, time for discussion and the presentation of projects and exercises will be provided systematically, with the aim of encouraging students to participate actively in class and develop transversal skills.

TYPES OF TEACHING

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

Evaluation tools and percentages of final mark
- Written test, open questions  40%
- Multiple choice test  30%
- Exercises, cases or problem sets  10%
- Teamwork assignments (problem solving, Project design)  20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The academic subject has two modalities of evaluation: final and continuous. Continuous evaluation, which the student can sign up for voluntarily, is only offered to those students who can carry out a continuous follow-up of the subject within the established timeframe and attend teaching activities.

Pre-enrolment in continuous evaluation will be done within the established dates. The pre-enrolment will become definitive after the confirmation of the application by the student within the established dates (between 60% and 80% of the course) and after a previous check on his/her performance by the teaching staff. If, within these dates, the student does not confirm his/her enrolment in continuous evaluation it will be understood that he/she opts for leaving it.

Overall evaluation:
- Written exam in the ordinary and extraordinary evaluations that are established.
  Final exam 100%
  Laboratory (must be performed at least 80% of those required) and practical work (at least a 5 mark must be obtained), are compulsory and must be performed before the exam.

Continuous evaluation will be done in the following tests:
- Three written tests (exams): 28 % + 28 % + 14 %
  (To continue in continuous evaluation, the student must obtain a minimum 3.5 mark (out of 10) in all the exams
- Group work, plus presentation: 20 % (it is compulsory to obtain at least a 5 mark in the practical work)
- Laboratory work: 10%

Moreover, for the continuous evaluation an attendance of the (80% is required)

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Assessment in extraordinary evaluation mode:
- Final exam 100%
  Laboratory (must be performed at least 80% of those required) and practical work (at least a 5 mark must be obtained) are compulsory. They must be done before the exam.

MANDATORY MATERIALS
<table>
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<tr>
<th><strong>BIBLIOGRAFÍA</strong></th>
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| **OBSERVATIONS** |
COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics
Degree GINFOR20 - Bachelor's Degree in Informatics Engineering

COURSE

26217 - Computer Graphics

COURSE DESCRIPTION

The primary aim is to train students to create images of virtual scenes. To this end different ways of representing objects will be considered, students will learn to transform objects to place them in a virtual scene, and in turn to control the camera with which they are to capture the scene in question. An overview will be given of computer graphics and basic concepts: transformations of objects and camera views, representation of three-dimensional objects and algorithms to generate images.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

.- General overview of the basic concepts in computer graphics.
.- Transformations of the objects and camera view.
.- Representation of 3D objects and image generation algorithms.

CONTENIDOS TEÓRICO-PRÁCTICOS

Topic 1 Introduction and basic concepts
Familiarisation with computer graphics concepts, understanding the problems in generating images, information discretisation, aliasing, basic line algorithms.

Topic 2 Geometrical transformations
Transformations applicable to three-dimensional objects, matricial representation of transformations, use of homogeneous coordinates, concatenation of transformations

Topic 3 Systems of reference, changes in systems of reference. The camera

Topic 4 Classification of models of representation of objects
Different ways of representing 3D objects. Usefulness of each of them: spatial division, polygonal, solid, implicit, curves and polynomial surfaces.

Topic 5 Lighting a point. Overall lighting of the scene

Topic 6 Visibility and image generation algorithms.

TEACHING METHODS

Classroom hours will include two types of session. Firstly, sessions led by the lecturer and secondly, those based on students’ laboratory work.
In the guided sessions, in some cases students will be given theoretical explanations in the form of a lecture. On other cases, active methodologies will be used, based on the collaboration of students.
On the other hand, students will use practical laboratory sessions to do their own work.
Students will have to finish any work not completed in the laboratory outside the class. Doing the laboratory work means using the techniques and algorithms explained by the lecturer. Students must therefore spend some time outside the classroom on assimilating these techniques.
The time planned outside teaching hours is due primarily to the time needed to assimilate the concepts explained in class: this assimilation is necessary both for the laboratory tasks and for the examination.
## TYPES OF TEACHING

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### Evaluation tools and percentages of final mark

- Continuous evaluation
- End-of-course evaluation

### Evaluation methods

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

### ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Based on the basic concepts presented in the course, the students will have to create an application to create 3D scenes. The application has to provide tools to transform the objects and control the camera (the application should show scene from the camera's perspective).

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The same as above

### MANDATORY MATERIALS

**BIBLIOGRAFIA**

**Basic bibliography**


**Detailed bibliography**


**Journals**

- Web sites of interest
  - http://www.opengl.org/
  - http://www.eg.org/
  - http://education.siggraph.org/

**OBSERVATIONS**
## COURSE GUIDE 2021/22

<table>
<thead>
<tr>
<th>Faculty</th>
<th>226 - Faculty of Informatics</th>
<th>Cycle</th>
<th>Not Applicable</th>
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<tr>
<td>Degree</td>
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### COURSE

26218 - Data Mining

| Credits, ECTS: | 6 |

### COURSE DESCRIPTION

This subject focuses on a field known as data mining or machine learning. It includes a series of techniques which, being based on artificial intelligence and classic statistics, have emerged strongly in the last decade for solving problems using large volumes of data. Its applications range from bioinformatics or finance to marketing-advertising, and also natural language.

Although the technological giants have been in the vanguard of this discipline for years, over the last few years more and more small- and medium-sized companies and institutions are becoming aware of the need to store data on their activities, and to analyse them to draw useful conclusions for their day-to-day operations. In the case of Euskadi, the machine tool sector and the term 'Industry 4.0' have increased the profile of our discipline.

The subject is closely linked to other computing subjects such as Artificial Intelligence and Algorithm Design; optional subjects include Heuristic Searches, plus others from other specialities related to databased and computing systems.

Students will study the main data mining techniques and will become familiar with real programs.

### COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Main data mining techniques will be studied, and the student will acquire skills in the use of free software which implements those techniques. The student will also show real data mining applications. Skills on the basic, international machine learning vocabulary will be acquired by the student.

### CONTENIDOS TEÓRICO-PRÁCTICOS

#### Theme 1 Introduction to data mining

- Applications and success stories. Everything related to data mining as a discipline within the field of artificial intelligence.

#### Theme 2 Distance-based classifiers: k-nearest neighbour

- The intuitive nature of this classic method of data mining makes it ideal as the first technique of supervised classification.
- Its basic functioning will be studied, together with its main variants and parameters for use.

#### Theme 3 Techniques to evaluate and validate classifiers

- Study of the main techniques for evaluating classifiers, with special emphasis on supervised classification methods and the estimation of success rates. Introduction to the main statistical tests for comparison between different classifiers.

#### Theme 4 Classification trees and decision rules

- Study of these two algorithms, inspired by the philosophy of 'divide and rule', with special emphasis on the transparency and simplicity of its final models. Different growth and pruning options will be explained.

#### Theme 5 Classifiers based on Bayesian networks

- Study of the basic theory underlying Bayes' theorem. Classification models of different complexity will be explained. We will examine the following applications of this type of classifiers: models for diagnosis and prognosis in medicine (evidence-based medicine, computational medicine).

#### Theme 6 Combination of classifiers

- Study of the different techniques used to combine classifiers. The virtues of the consensus reached by classifiers will be highlighted.

#### Theme 7 Techniques for selecting variables

- Study of basic concepts and techniques, both from the univariate and the multivariate points of view. Applications of this type of techniques: most important genes in an illness (a new area of bioinformatics).

#### Theme 8 Non-supervised classification (clustering)

- Main clustering techniques. Describing the characteristics of this type of problem, differentiating them from the supervised ones. Practical examples: image segmentation, groups of foodstuffs based on their nutritional characteristics, segmentation of customers and targeted marketing and advertising.
Theme 9 Introduction to heuristic searches and genetic algorithms

Theme 10 Introduction to neural networks
Basic mechanisms of a neural network classification structure. Main neural network architectures. The subject is a motivation for a further course in the Faculty: "Machine Learning and Neural Networks"

TEACHING METHODS
Three lessons per week. One practical laboratory with computers (personal laptop, or provided by the Faculty), and two theoretical lessons.

TYPES OF TEACHING

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Evaluation methods
- End-of-course evaluation

Evaluation tools and percentages of final mark
- Written test, open questions  60%  
- Exercises, cases or problem sets  40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT
A mid-exam, consisting of the 70% of the theoretical material, will be realized by the beginning of November. A last-exam, asking for a minimum mark, consisting on the rest of the theoretical material, will be realized by January. At least two deadlines will be announced to collect the practical laboratories developed by the student.

In order to pass the subject, it is needed to pass both parts: theory and practice.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT
A final examen in January consisting in the 100% theoretical material. If the student has not delivered the practical laboratories during the weeks of the course, those must be delivered to the teacher one week before the final theoretical exam.

In order to pass the subject, it is needed to pass both parts: theory and practice.

MANDATORY MATERIALS
"egela" system is used to guide the "day-per-day" of the course: material of the theoretical lessons, as well as the formulation of the practica-laboratory sessions.
BIBLIOGRAFÍA

Basic bibliography
- J. Han, M. Kamber (2006). Data Mining: concept and techniques. Morgan Kaufmann. (Second edition)

Detailed bibliography

Journals
- Data Mining and Knowledge Discovery. Springer.

Web sites of interest
- WEKA software: http://www.cs.waikato.ac.nz/ml/weka/
- Datasets' benchmark repository (University of California Irvine): http://archive.ics.uci.edu/ml/
- A list of intuitive data mining applications, described in a divulgative style (updated by the teacher): http://www.sc.ehu.es/ccwbayes/members/inaki/DM-applications.htm
- LiO software for heuristic optimization: http://www.dsi.uclm.es/simd/SOFTWARE/LIO/

OBSERVATIONS
COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics  Cycle Not Applicable
Degree GINFOR20 - Bachelor's Degree in Informatics Engineering  Year Fourth year

COURSE

26230 - Formal Methods in Software Development  Credits, ECTS: 6

COURSE DESCRIPTION

Formal methods make software development acquire a more scientific character and similar to other disciplines related to engineering, as well as promote the use of tools with solid foundations, as occurs in other well-established disciplines. These methods are called formal because they are based on mathematics, mainly on mathematical logic. Some years ago the industrial development of system using formal techniques was considered a complex theoretical exercise and unfeasible in real problems. However, the increasing complexity and importance of the computer systems ended up making patent the importance of construct reliable and safe systems, i.e. systems that lack errors or failures. Not only because of the terrible repercussions these failures can have in areas where security is critical, but also because of the economic and quality repercussions that affect companies. This, together with the fact that computer systems play an increasingly essential role in society (in particular, they are more and more present in the devices that we use every day) made the industrial world change its attitude. Thus, in the last decades, formal methods have gained a notable advance and their use in the industrial field has ceased to be the utopia that their detractors claimed. Currently there are large companies, such as Intel, IBM, Sony, Siemens, Amazon or Microsoft, which collaborate very actively both in the creation of tools to help formal software development, and in the application of these tools to obtain reliable industrial applications. In fact, this course uses a software development tool created by Microsoft: Dafny. Although the usefulness of formal methods, and their efficiency, in industrial developments are already proved, more work is still needed for most engineers to know and apply them. This work must be carried out by the universities that must include them in their academic content; by the teachers, who must be trained and researched in this area of knowledge; and by the students, who must have a more solid formation in mathematics and logic. This course contributes to this task of ensuring that the software engineer's work is true engineering, so that the end user receives reliable and safe products.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The specific objectives of this subject are:
- Understand the importance of programming being a more scientific than craft activity.
- Know the history and motivation of formal methods of software development.
- Know the state of the art in the area of formal software development.
- Know the languages, methods and concrete tools of formal software development.
- Ability to handle languages and concrete tools of formal software development.

CONTENIDOS TEÓRICO-PRÁCTICOS

Topic 1.- Introduction
Topic 2.- Mathematical Induction
Topic 3.- Introduction to the Dafny System
Topic 4.- Generation of Verification Conditions
Topic 5.- Proving Properties and Software Development in Dafny
Topic 6.- Structural Induction and Datatypes
Topic 7.- Ghost Entities
Topic 8.- Dynamic Memory.

TEACHING METHODS

TYPES OF TEACHING

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

Evaluation tools and percentages of final mark
In order to pass the subject in continuous evaluation, students must complete and deliver several (five or six) individual practical works that prove their knowledge of the tools and techniques that are addressed in class. Students will receive feedback on these works as the teacher corrects them, so that they are useful for learning.

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

- Individual assignments 100%

MANDATORY MATERIALS

- Lectures slides.
- The on-line tutorial and the documentation of the Web page:

BIBLIOGRAFÍA

Basic bibliography

- The on-line tutorial and the documentation of the Web page:

Detailed bibliography


Journals

- ACM Transactions on Computational Logic
- ACM Transactions on Software Engineering and Methodology
- Applicable Algebra in Engineering, Communication and Computing
- Formal Aspects of Computing
- Formal Methods in System Design
- Journal of Automated Reasoning
- Software Testing Verification & Reliability

Web sites of interest

- Dafny: a language and program verifier for functional correctness

- The Verification Corner (Microsoft Research):

- Formal Methods and Software Technology - Interesting Conferences
  http://user.it.uu.se/~bengt/Info/conferences.shtml

OBSERVATIONS
COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics
Degree GINFOR20 - Bachelor's Degree in Informatics Engineering
Cycle Not Applicable
Year Fourth year

COURSE

26260 - Digital Processing of Audio & Video
Credits, ECTS: 6

COURSE DESCRIPTION

This subject is an elective course of the 4th year of the Informatics Engineering Degree in the speciality Computer Engineering (taught during the first four-month period).

The subject is intended to introduce the student of Computer Science to both the theoretical and practical aspects of Digital Signal Processing. Therefore, the subject uses concepts learned in previous subjects in the areas of mathematics (complex numbers, sinusoidal, etc.) and programming. In the professional field, the subject enables students to process digitally any type of signal (sound, image, information from sensors, time series, etc.) in multiple fields (audio-visual, industry, medicine, meteorology, etc.). In this way, it serves as a link to other areas such as Data Science, Big Data, Industry 4.0, etc.

The fundamental objectives are:

- To introduce the student to the basic concepts related to Digital Processing: signals, systems, time and frequency analysis, filters.
- To deepen these concepts in the case of sound and image, and to show the methods used in digital systems to capture, process and produce this type of signals.
- To present practical applications of these techniques and alternatives for their implementation.
- To put into practice the concepts studied, applying them in the laboratory to real cases of sound (voice and music) and image processing, using a specific software as MATLAB, SCILAB, Octave, Python, etc.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The learning outcomes provided by the subject are the following:

- Knowing how to use digital signal processing software and critically interpret the results obtained.
- Being able to apply the mechanisms of transformation of continuous signals to digital signals: sampling and quantification.
- Know the main methods of calculating the Fourier transform and know how to apply them to digital signals.
- Knowing the main parameters of FIR and IIR digital filters, and knowing how to design and apply them to digital signals.
- Develop a specific task with autonomy using self-management and self-regulation techniques.
- Communicate their ideas and arguments in an understandable way and according to the established formal criteria.
- Value teamwork, accepting the potential of diversity as a learning opportunity.
- Carry out their tasks responsibly in order to achieve the objectives and the collective result.

CONTENIDOS TEÓRICO-PRÁCTICOS

Theme 1
1.1 Introduction
1.2 Signals and systems Why digital processing?

Theme 2
2.1 Digital signals
2.2 Definitions and properties. Digitization. Basic signals and operations. Sound and image
2.3 Project: Introduction to a specific software for digital signal processing: Sound and Image
Theme 3
3.1 Time domain analysis
3.2 Usual operations. Windowing and short-term operations. Correlation
3.3 Projects: Analysis of sound and image signals

Theme 4
4.1 Frequency domain analysis
4.2 Starting idea. Fourier series and transform. Application to two-dimensional systems
4.3 Projects: Frequency analysis of sound and image signals

Theme 5
5.1 Filters.
5.3 Projects: Linear systems (FIR, IIR) and filter design.

Theme 6
6.1 Applications of digital signal processing.
6.2 Areas of application and examples.
6.3 Final projects: medium/high complexity projects in which acquired competencies in the subject are applied.

**TEACHING METHODS**

There are four types of activities:

- Autonomous study by the students of the material available in the virtual classroom for each subject in which the theoretical/practical concepts to be used are presented, as well as a proposal of exercises associated with them. In addition to directly accessible information, students can use bibliographic references as support material.

- Presentation and exercise classes in which, in a participative way, the theoretical/practical concepts of each topic are shared and the doubts associated with them are clarified, always emphasizing their usefulness and practical aspects. In these sessions, the initially proposed exercises (“on paper”) will be shared in order to deepen the theoretical foundations. Exercises will also be proposed on each topic that the students will have to solve and that will be evaluated with the corresponding feedback.

- Development of specific projects in which the students (in groups of 2) apply the theoretical/practical concepts learned to real cases of sound (voice and music) and image processing, using MATLAB, SCILAB, Octave, etc. For each of these sessions, a technical report of results must be submitted that will be evaluated with the corresponding feedback.

- Development of a final project (medium/high complexity level) in which the students (in groups of 2) will apply the theoretical/practical knowledge previously learned in the course. In order to facilitate student learning, specific projects will be monitored by providing feedback based on previously established and shared evaluation criteria. In this way, students are aware of their level of learning and take steps to improve it if necessary.

In the event of having to teach the subject in distance learning mode, the lectures would be transformed into classes through a BBC type platform, in which the most relevant aspects of the material uploaded to eGela would be discussed, and any doubts raised by the students would be resolved.

The rest of the course structure would not be affected as it is designed as a self-study course with teacher support (project-based learning).

**TYPES OF TEACHING**

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- TI: Industrial workshop
- GCA: Applied fieldwork groups

**Evaluation methods**
- Continuous evaluation
- End-of-course evaluation
### Evaluation tools and percentages of final mark

- The percentages and types of assessment are specified in the following sections 100%

### ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the ordinary call for proposals, the preferential assessment system will be in the form of continuous assessment. The mark is calculated as follows:

- Exercises in the classroom: 20%.
- Deliveries of specific projects: 30%
- Final project: 20%.
- Final knowledge test: 30% (only for students who have not passed a certain mark in the continuous assessment).

If the course is taught in a distance learning mode, the classroom exercises will be carried out remotely. And the final knowledge exam will be carried out by means of an eGela questionnaire, with a weight of 15%. In this case, the final project would have a weight of 30% and the specific projects 35%.

For the final assessment mode, the students will have to submit the reports corresponding to the specific projects and the final project before the date of the final knowledge test. In this case, the examination will weigh 60% and the practical part 40%. In the event of not being able to take the final knowledge exam in person, the weight of the questionnaire via eGela would be 15%, and the practical part would have the following weights: exercises to be submitted solved (20%), specific projects (35%), final project (30%). A timetable of the corresponding deliverables would be scheduled according to the final assessment.

To pass the course, in any modality, it is necessary to pass the final knowledge test. Students may waive continuous assessment before 50% of the course has been taught in writing addressed to the teachers.

NOTE: As mentioned above, in case of return to lockdown, the assessment (both continuous and final) will be carried out remotely via questionnaires, interviews and/or eGela submissions and through the BBC connection.

### EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the case of the extraordinary call, the final mark is calculated based on two parts:

- Theory (60%): Assessed by a knowledge test.
- Practical (40%): This is assessed on the basis of the technical reports corresponding to the specific and final projects, which must be submitted before the date of the theory test.

In order to pass the course it is necessary to pass both parts (theoretical and practical). In the case of non classroom teaching, the percentages mentioned in section 8 for that case would apply.

NOTE: As in the ordinary examination period, in case of return to lockdown, the assessment will be carried out remotely through questionnaires, interviews and/or eGela deliveries and via BBC connection.

### MANDATORY MATERIALS

For the correct development of the subject it is required:

- a PC type personal computer.
- and specific software for signal processing (MATLAB, etc.), for the laboratory practices.

The centre provides both resources. In addition, students have the possibility of carrying out the practical projects on their own computers using the UPV/EHU's MATLAB corporate licence and free software (SCILAB, Octave, Python, etc.).
BIBLIOGRAFÍA

Basic bibliography

Detailed bibliography

Journals
Digital Signal Processing (Elsevier)
Signal Processing (Elsevier)
IEEE Signal Processing Letters

Web sites of interest
www.mathworks.com
www.sciLab.org
www.dsprelated.com
www.gnu.org/software/octave
www.scipy.org

OBSERVATIONS
The objective of this subject is to study the structure and functioning of the electronic elements that allow communicating digital systems, in particular a computer, with the outside world. It begins studying the elements that capture and condition the signals of the real world. Next, the basic circuits for processing these signals are studied: analog, digital, analogue digital conversion, data acquisition cards and signal processing (DSP). This subject is completed with some practical simulation and design exercises using widely used programs in the field of electronic circuit design. All this will be very useful when dealing with topics such as: the design of integrated circuits, design of applications based on microprocessors, the study of signal processing or robotics, etc., object of other subjects of the degree.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The expected learning outcomes are:

- Be able to handle with the basic instrumentation of an electronic laboratory.
- Be able to identify the appropriate sensor for the capture of a certain physical signal.
- Be able to design a basic signal conditioning device (amplification and filtering).
- Be able to simulate the operation of analog electronic circuits.
- Be able to design an analog to digital and digital to analog conversion circuit.
- Be able to process information received from sensors with data acquisition systems.

CONTENIDOS TEÓRICO-PRÁCTICOS

UNIT 0. Introduction: Interface with the real world.
UNIT 1. Acquisition of signals: sensors.
UNIT 2. Conditioning of signals: the operational amplifier and its applications.
UNIT 3. A / D and D / A converter circuits.
UNIT 4. Cards and data acquisition systems (DAQ).

TEACHING METHODS

Active methodologies of cooperative learning will be used, looking for the active participation of the students and the work in-group, something fundamental for the achievement of the desired competences in this specialty.

In addition to theory classes, practical laboratory sessions based on cooperative learning are proposed. The content of the practical topics is developed in the laboratory, in-group.

TYPES OF TEACHING

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Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- The percentages and types of evaluation are specified in the subsequent sections 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Evaluation of the subject is continuous. In evaluation, quality and mode of presentation of the assigned work, problems resolution, written tests, the work carried out in the laboratory, as well as the attendance to classes are taken into account.
Percentages and types of evaluation:

Exercises 15%
questions 20%
Laboratory 35%
attendance 10%
Tests 20%

Total: 100%

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The final exam consists on a written test in which the degree of knowledge of the subject, both theoretical and practical, treated in the subject will be evaluated

MANDATORY MATERIALS

Documentation provided by the teacher in egela.

BIBLIOGRAFÍA

Basic bibliography
 BOLTON W., 2001. Mecatrónica: Sistemas de control electrónico en la ingeniería mecánica y eléctrica. (Marcombo)

Detailed bibliography
 BISHOP R., 1999. Learning with LabVIEW. Addison-Wesley
 NORTON H.N., 1982. Sensores y analizadores. (Gustavo Gili)

Journals
 IEEE Instrumentation and measurement magazine
 IEEE transactions on instrumentation and measurement
 IEEE Robotics and automation magazine
 IEEE sensors Journal
 IEEE signal processing magazine
 IEEE transactions on circuit and systems II. Analog and digital signal processing
 IEEE transactions on industrial electronics and control instrumentation
 Revista española de electrónica (http://www.redeweb.com/index.php?option=com_frontpage&Itemid=1)
 Electronic Design ( http://electronicdesign.com/index.cfm?AD=1&
Web sites of interest

LabVIEW: http://www.ni.com/labview/

OBSERVATIONS
COURSE GUIDE 2021/22

Faculty: 226 - Faculty of Informatics
Degree: GINFOR20 - Bachelor's Degree in Informatics Engineering

COURSE

26237 - Network Technologies & Infrastructures Credits, ECTS: 6

COURSE DESCRIPTION

Objectives

Acquire sufficient knowledge to take on the following tasks:

- Manage computer network infrastructures (local, corporate campus, data centre, or a corporate network with WAN links).
- Design computer networks.
- Manage teams of technicians responsible for these networks.
- Self-training in any specific area of networked technologies.

Context in the degree course

The subject:

- Deepens and extends the concepts and techniques seen in the "Introduction to Computer Networks" subject in the 2nd year.
- It complements the "Systems and Networks Administration" subject in the 3rd year.
- It provides a solid basis to the subjects "Komunikazio Mugikorrak eta Multimediakoak", "Network Design and Projects" and "Security, Performance and Availability of Services and Infrastructures" in the 4th year.

Previous knowledge

To take the course, it is necessary to have knowledge of the content of the subject "Introduction to Computer Networks" (2nd year). To do this, we recommend not enrolling in "Network Technologies and Infrastructures" if you have not previously passed "Introduction to Computer Networks".

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Contribution to the vocational training of students

- Knowledge of commonly-used technologies in the computer networks around us.
- Practical experience in the use of networked equipment, mainly switches and routers.
- Confidence in oneself when it comes to taking on responsibilities as a network engineer.

CONTENIDOS TEÓRICO-PRÁCTICOS

Theoretical credits
1. Data transmission
2. Local area networks
3. Wireless local area networks
4. Wiring systems for local area networks
5. Network design
6. Network interconnection
7. Network management

Practical credits
Work will be done on the GNS3 emulator.
Areas to be worked on:

1. Routing protocols: OSPF, BGP.
2. Local network technologies: Spanning Tree Protocol, VLAN, redundancy.

TEACHING METHODS

Teaching Methodology

Different teaching methodologies will be followed, using the most suitable one for each area to be worked on or skills to be acquired. In general, autonomous work and personal initiative will be encouraged for the search of information that can complement that provided in class.
Conceptual content in the subject will be introduced by lectures, with the students participating in occasional debates. Problem-solving in class will be done in a participative way. Problems and exercises to be solved will be given individually or in groups in order to facilitate the comprehension and assimilation of the technical concepts presented in class.

The formulation of questions and open discussion will be encouraged so that the student can acquire skills in oral communication, the ability to summarise and teamwork.

The practical credits will be in the laboratory, working on the GNS3 network emulator.

**TYPES OF TEACHING**

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**Evaluation methods**

- Continuous evaluation
- End-of-course evaluation

**Evaluation tools and percentages of final mark**

- RESOLUCION CASOS PRÁCTICOS EN LABORATORIO 100%

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

Assessment

To facilitate and ensure student learning, feedback will be given based on previously established criteria of continuous assessment, so that students will have the opportunity to become aware of their learning and of ways to improve it.

The weight of assessment of the theoretical part in the final grade is 70%, and the practical part 30%.

To withdraw from the call, it is just enough to not present one of the assessment assignments.

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

In the extraordinary call, assessment is done in a written exam in which the weight of the theoretical part is 70% and the practical part 30%.

To withdraw from the call, it is enough to not present oneself at the exam.

**MANDATORY MATERIALS**

* Material publicada en el aula virtual de la asignatura: egela.ehu.eus

**BIBLIOGRAFÍA**

**Basic bibliography**


**Detailed bibliography**

- 802.11 Wireless LAN Fundamentals, P. Roshan and J. Leary, Cisco Press, 2004

**Journals**
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS. http://www.jsac.ucsd.edu/

Web sites of interest

http://williamstallings.com/DCC/DCC8e.html


http://authors.phptr.com/tanenbaumcn4/

http://www.cisco.com

OBSERVATIONS

Lo definido en esta guía, y especialmente lo referido a evaluación, puede verse alterado de forma extraordinaria en función de la evolución de la pandemia declarada por el virus COVID-19.
COURSE GUIDE 2021/22

Faculty 226 - Faculty of Informatics  Cycle Not Applicable
Degree GINFOR20 - Bachelor's Degree in Informatics Engineering  Year First year

COURSE

26013 - Programming Methodology  Credits, ECTS: 6

COURSE DESCRIPTION

“Programming Methodology” complements the knowledge of the previous subject called “Basic Programming” adding formal aspects to the algorithm design.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Skills in analysis, design, implementation, and maintenance of correct software
Skills in program specification, documentation, validation, and verification
Skills to reason about program properties
To know the relationship between iteration and recursion
To know techniques for correct program transformation

CONTENIDOS TEÓRICO-PRÁCTICOS

1) Specification, Correction and Design by Contract
2) Preconditions and Postconditions. Formal Specification
3) Hoare's Formal System
4) Recursion
5) Algebraic Specification of Abstract Data Types
6) Burstall's Method

TEACHING METHODS

The student has to read the book and do the exercises provided at the end of the chapters (after the classes). The theoretical classes will focus on providing general information about the discipline, solving doubts about the subject and resolving different kinds of exercises.

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

Evaluation tools and percentages of final mark
- Written test, open questions 90%
- Exercises, cases or problem sets 10%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The subject has two modes of assessment: by final (or overall) assessment and by continuous assessment.
CONTINUOUS EVALUATION: The student will be able to take part voluntarily in it, since it is offered exclusively for those who can carry out the continuous monitoring of the subject within the established framework of dedication and assistance to presental activities. Pre-enrolment in the continuous assessment mode will take place during the first week of the course. Pre-enrolment will become definitive after confirmation of the application by the student on the dates established (around the 12th week with approximately 70% of the weight of the evaluation already completed) and after verification of partial performance by the teaching staff. If the student does not confirm his or her definitive enrolment in the continuous assessment on the above-mentioned dates, it will be understood that he or she dismisses this enrolment.
The course is focused on continuous assessment.
Three written tests will be developed with a weight of 20%+ 40% +30%. Laboratory work will account for 10%.
FINAL EVALUATION: This will be applicable to students who do not wish to take part in the system of continuous assessment and to those who do not pass the conditions for final registration.
In this case, a final examination of competence must be done. It will be carried out according to the official schedule of examinations of the Faculty and which will represent 100%. The minimum grade required in the final exam will be 5 out of
EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A final examination of competence where the minimum grade is 5 out of 10.

MANDATORY MATERIALS

Support material is available in the eGela virtual classroom.
A laboratory of recursion is done using ADA programming language.

BIBLIOGRAFÍA

Basic bibliography
- Especificación, Verificación y Derivación Formal de Programas.
- Programazioaren Metodologia.
  Alvez J., Arregi X., Lucio P., Maritxalar M. Open Course Ware. UPV/EHU. 2013.

Detailed bibliography

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

Web sites of interest
http://en.wikipedia.org/wiki/Formal_verification
http://en.wikipedia.org/wiki/Collatz_conjecture
http://ocw.ehu.es/course/view.php?id=191

OBSERVATIONS
"Advanced Information Management" is a compulsory subject within the Specialty of Software Engineering. This subject rests on aspects taught in "Web Systems" and "Databases". On the one hand, the knowledge on XML technologies seen in "Web Systems" is broadened. On the other hand, the new data management needs that go beyond the relational model are addressed.

The management of data has been and is, increasingly important in any organization. From the systems of files and databases, the current organizations have had to face new challenges as the volume, diversity and the means in which these data were transported, managed and produced increase. This subject familiarizes the student with these new information technologies.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

The topics to be discussed are outlined below.

Document exchange between organizations: the XML world and description standards
* See the options offered by the XML language for the organization of unstructured data as well as some available standards
* Understand the use of XML for data exchange in companies and do it through a prototype

Impact of object orientation on DBMS: the object-relational model
* Through the new versions of Oracle, understand and manage how the concepts of object orientation have permeated the definition and manipulation of databases.

Impact of "datafication", that is, the transformation of everyday objects into data that add to the sea of massive data that the Internet already houses, the product of our fingerprints through social networks or smartphones.
* Understand the concepts and opportunities of the BigData world
* Become familiar with noSQL databases.

Learning results will be worked on
- general: C1, C2, C3, C4, C5, C6, C7, C8, C9, C10 and C12
- more specific to Ing. Soft: SI1, SI2, SI3, SI4, SI5, and SI6

**CONTENIDOS TEÓRICO-PRÁCTICOS**

1. Standards and XML technology for document interchange (XPath, XML Schema, Schematron, XQuery, xSQL)
2. Modelo Objeto-relacional (Oracle 10)
3. noSQL (MongoDB, Neo4j)

**TEACHING METHODS**

According to the eminently practical content of the subject, lectures are accompanied by weekly laboratories where students will check their understanding of the concepts taught through solving practical exercises. Student groups will be set to jointly develop a project that will involve the intensive use of XML technologies.

**TYPES OF TEACHING**

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**Evaluation methods**
- Continuous evaluation
Evaluation tools and percentages of final mark

- Exercises, cases or problem sets 90%
- Teamwork assignments (problem solving, Project design) 10%

ordinary examination period: guidelines and opting out

The course has two modes of assessment: final (or overall) assessment and continuous assessment.

Continuous assessment
Continuous assessment, to which students may take advantage of voluntarily, is offered exclusively to students who can carry out continuous monitoring of the subject within the established framework of dedication and attendance to face-to-face activities. Pre-registration in the continuous assessment mode will be carried out on the established dates. The pre-registration will become final after confirmation of the application by the student on the dates established (between 60% and 80% of the course) and after verification of partial performance by the teaching staff. If on the aforementioned dates the student does not confirm their final registration in continuous assessment, it will be understood that they renounce it.

Weight of each topic in the final note:
- XML: 65%
- Object-Relational: 15%
- noSQL: 20%

Assessment of the whole
- Final exam: 90% The exam will consist of a part of basic concepts and practical written exercises.
- Practical work: 10%. To take the final exam of the overall assessment (in the ordinary or extraordinary call), the work of the XML project must have been submitted. A deadline for delivery will be set prior to the exam. To pass the course it will be necessary to pass each part (exam, practical work) separately.

note: In case of return to confinement, the evaluation tests (both continuous and final) will be adapted to the new situation.

extraordinary examination period: guidelines and opting out

Final exam: 100% The exam will consist of a part of basic concepts and practical written exercises.

note: In case of return to confinement, the evaluation tests (both continuous and final) will be adapted to the new situation.

Mandatory materials

Software to be used throughout:
- OXYGEN XML Editor
- ORACLE DBMS
- MongoDB DBMS noSQL
- Neo4J DBMS noSQL

Bibliografía

Basic bibliography
XQuery. P. Walmsley. 2007, O&#8217;Reilly.
Detailed bibliography
Journals

Web sites of interest
http://www.w3schools.com/

http://infolab.stanford.edu/~ullman/fcdb/oracle/or-objects.html

OBSERVATIONS
### COURSE GUIDE 2021/22

<table>
<thead>
<tr>
<th>Faculty</th>
<th>226 - Faculty of Informatics</th>
<th>Cycle</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree</td>
<td>GINFOR20 - Bachelor's Degree in Informatics Engineering</td>
<td>Year</td>
<td>Third year</td>
</tr>
</tbody>
</table>

### COURSE

| 25987 - Project Management | Credits, ECTS: 6 |

### COURSE DESCRIPTION

The course corresponds to the field of Computer Project Management, has six credits and is taught in the third year of the Degree in Computer Engineering.

The specific training in Project Management in the university degrees in Computer Science appears, in general, in the mid-nineties, on the occasion of the transformation of the curricula of the Degree in Computer Science to the engineering degrees. In the process of adaptation to the structure of the Degree and Master, basic training in Project Management was included among the competencies of both the Degree and the Master in Computer Engineering. The technical skills include those related to the management of computer projects within the common block to the branch of Computer Science, defined in the recommendations for the degrees in Computer Engineering.

When students take this course they are finishing their third year, so the aim is to provide them with knowledge and resources that will be useful in the last stage of their training and in their subsequent professional practice.

Although there are no specific prerequisites in the study plan, it is recommended that, before taking this course, the student should have passed the credits corresponding to the first five semesters or, at least, the 120 credits of the first two courses.

In addition to the academic environment defined by the curriculum of the Degree in Computer Engineering, and independently of the fact that the management of computer projects has well known specificities, the basic competences to be developed to manage this type of projects are perfectly framed in the characterization of the International Project Management Association (IPMA) and the Project Management Institute (PMI), which are the basic references in Project Management in Engineering.

### COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

In short, the student will be able to:

- Identify the main stages, activities and roles related to the planning, monitoring and control of projects.
- Identify and put into practice estimation and planning skills, applying previous experiences and knowledge.
- Detect situations that in a project require decision making and introduction of changes, being able to manage such situations.
- Identify the fundamental aspects of the management of information and communication systems associated with the life cycle of a project.
- Identify some specificities of IT projects and professional roles involved in various types of IT projects.
- Identify and take into consideration the organizational, regulatory, legal and deontological environment in which the professional activity is developed and, in particular, its impact on the activities related to the projects.
- To develop and apply technical and behavioural competencies in individual and team work, within the conceptual framework of the Bases for Competence in Project Management.

### COMPETENCES TO BE WORKED ON IN THE COURSE

* Students will demonstrate possession and understanding of aspects involving knowledge from the forefront of their field of study.
* Students will be able to apply their knowledge to their work or vocation in a professional manner and will possess the skills usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.
* Students will have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues.
* Students will convey information, ideas, problems and solutions to both specialized and non-specialized audiences.
* Students will develop those learning skills necessary to undertake further studies with a high degree of autonomy.
* Ability to conceive, write, organize, plan, develop and sign projects in the field of computer engineering
* Ability to plan, conceive, deploy and manage projects, services and computer systems in all areas, leading their implementation and continuous improvement and assessing their economic and social impact
* Ability to draw up the technical specifications of an IT installation that complies with current standards and regulations.
* Capacity to direct the activities subject to the projects in the field of computer science in accordance with the knowledge acquired
* Ability to know, understand and apply the necessary legislation during the development of the profession of Computer Engineer and handle specifications, regulations and standards of mandatory compliance.
* Ability to design, develop, select and evaluate computer applications and systems, ensuring their reliability, security and quality, in accordance with ethical principles and current legislation and regulations.
* Knowledge of IT rules and regulations at national, European and international levels.
* Knowledge of basic subjects and technologies, which enable the learning and development of new methods and technologies, as well as those that provide them with a great versatility to adapt to new situations.
* Ability to solve problems with initiative, decision-making, autonomy and creativity. Capacity to know how to communicate and transmit the knowledge, skills and abilities of the profession of Computer Science Engineer.
* Ability to understand the importance of negotiation, effective work habits, leadership and communication skills in all software development environments, in line with the transversal competences of the UPV/EHU’s Catalogue of Transversal Competences.
* Knowledge to carry out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, task planning and other similar computer work.
* Ability to analyse and assess the social and environmental impact of technical solutions, including aspects of sustainability in line with the UN's Sustainable Development Goals, in particular the objectives of climate action, responsible production and consumption, decent work and democracy and strong institutions through materials (videos, websites, questionnaires) produced by the students of the previous year as deliverables in the projects of the course, including the ethical and professional responsibility of IT engineering activity.
* Knowledge and application of basic elements of economics and human resource management, project organisation and planning, as well as legislation, regulation and standardisation in the field of IT projects.

CONTENIDOS TEÓRICO-PRÁCTICOS

Item 1 PROJECT PLANNING.
Item 2 PROJECT MONITORING AND CONTROL
Item 3 PROJECT MANAGEMENT. The role of the Project Manager. Training and development of the professional role in project management.
Theme 4 PROJECT MANAGEMENT SYSTEMS AND RESOURCES. Information System. Communication System.
Topic 5 THE COMPUTER PROJECT.
Item 6 INDIVIDUAL PROFESSIONAL COMPETENCES.
Item 7 TEAMWORK.
Item 8 THE REGULATORY AND DEONTOLOGICAL ENVIRONMENT.
Item 9 THE ORGANIZATIONAL ENVIRONMENT OF A PROJECT.

TEACHING METHODS

The course is taught taking into account three types of face-to-face online activities: master classes, exercise classes and discussion and teamwork sessions. The teaching of will be given using active methodologies. Specifically, during the development of the classes and the laboratories, group work activities, discussion and presentation of exercise results will be carried out systematically, in order to promote the direct participation of the students and to encourage their motivation in the development of the course.

Active teaching methodology, based on a systematic and punctual attendance to classes, presentation of results, tests of lessons learned and the realization of works, both individually and in teams.

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>40</td>
<td>20</td>
<td>60</td>
<td>30</td>
<td></td>
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</tbody>
</table>

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

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

Evaluation tools and percentages of final mark
- Los porcentajes y tipos de evaluación se especifican en los apartados posteriores. 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of this subject is based on two exclusive modalities:

1. Continuous evaluation. Based on systematic and punctual attendance to online sessions, presentation of results, tests of lessons learned and the completion of work, both individually and in teams, from the beginning of the term until the beginning of May (estimated completion date the week of May 13). The qualification will be obtained from the following
activities:

a. S1-S2. Registration exam in Continuous Assessment: 15% of the grade. It includes the evaluation of all the work (projects, homework and classes) of the first two weeks of class.

b. S2-S8. Development of two incremental projects (in pairs, P2, and in teams of three/four during the following three weeks; 20 and 25% of the grade, respectively) over seven weeks. An individual examination will be held after the ninth week of classes. Project grades will have an individual component that will be assessed by means of the written test, which will serve to define and consolidate the provisional grades of previous projects.

c. Overall project (approximately 40% of the mark, see sub-sections c and d). Development of a project by a team of at least five people, over a period of six weeks during the second part of the term. The qualification of the overall project will have an individual component that will be evaluated by means of the written test in the fourteenth school week. If the project is submitted on time and meets the basic quality criteria, students may choose not to take the exam and obtain a passing grade.

d. Development of the Lessons Learned Document. The work done and the associated deliverable will modulate the grades obtained in the P3 and P4 projects.

e. As an integral part of the assessment process, assignments will be developed during the online sessions throughout the course. These tasks are mandatory in this evaluation mode. The deliverables and presentations of these assignments will be integrated into the student performance assessment process, complementing the grade obtained in the projects.

2. Evaluation based on final exam. Within the established time frame and working method, it does not require class attendance, although it does require the planning, dedication and monitoring of 120 hours of personal work prior to the exam. It will consist of two parts:

a. Development of the direction of a project, which must be completed prior to the date of the written exam, meeting the milestones for intermediate deliveries. The project proposal, together with the project management model, must be submitted prior to the start of the project. The deadlines for the submission of the proposal and the project are, respectively, 20/III and 14/V (May call) and 29/IV-19/VI (June call). The delivery in time and quality is a requirement to pass the course. In parallel to the development of the project, the student must plan, follow up and control his/her dedication to the subject. The initial planning must be submitted before 21/II (May) or 20/III (June).

b. A final examination of competence will be held in three parts: the first, associated with the planning, monitoring and control of the subject and the scope of the project; the second, relating to the theoretical content, and the third, applying concepts of planning and project management to a practical case.

In order to renounce the call, it is sufficient to abandon the continuous monitoring activities before consolidating 60% of the qualification in continuous evaluation. In overall evaluation with not presenting the project or not attending the final exam.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A final examination of competence will have three parts: the first, associated with the planning, monitoring and control of the subject and the scope of the project carried out; the second, relating to the theoretical content, and the third on the application of planning and project management concepts to a practical case.

MANDATORY MATERIALS

Project Management Institute, Project Management Body of Knowledge (PMBOK), sixth edition. 2017

Apuntes de la asignatura: Técnicas de trabajo en equipo

Apuntes de la asignatura: Presentaciones en público

BIBLIOGRAFÍA

Basic bibliography

Dpto. de Educación, Universidades e Investigación del Gobierno Vasco, Metodología de trabajo en equipo, 2004

Fundación Vasca para la Calidad Euskalit, VI Curso Avanzado en Gestión de la Calidad, Facilitadores en métodos y herramientas de resolución de problemas, 1999

Técnicas de presentación: métodos y herramientas para lograr las mejores presentaciones, Cecsa, 2003

Detailed bibliography


C. Van-der Hofstadt, J. Gómez Gras, Competencias y habilidades profesionales para universitarios, Díaz de Santos, 2006

Journals
Novática. ISSN: 0211-2124

Web sites of interest
Project Management Institute: http:\www.pmi.org
Asociación Española para la Ingeniería de Proyectos (AEIPRO): http://www.aeipro.com/v3/
Euskalit: http://www.euskalit.net/

OBSERVATIONS
http://www.aenui.net/jenui2014/55.pdf