Universidad del País Vasco Euskal Herriko Unibertsitatea

ENGLISH FRIENDLY COURSES (EFC) 2024-2025
CAMPUS OF BIZKAIA

https://www.ehu.eus/en/web/bilboko-ingeniaritza-eskola/international_relations/incoming_exchange_students
Contact: ingenieria.internacional@ehu.eus

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

English Friendly Courses taught in SPANISH:

FACULTY OF ENGINEERING – BILBAO

	COURSE	SEMESTER[1]	CREDITS	SCHEDULE[2]	LINK TO SYLLABUS
Common courses					
27323	Proyectos de Ingeniería	Annual	6	A	➡
Bachelor`s Degree in Industrial Technology Engineering					
27317	Elasticidad y Resistencia de Materiales	1st	6	M	
27318	Automática y Control	1st	6	M	
27325	Materiales Estructurales: Comportamiento en servicio y mecánica de la fractura	1st	6	A	➡
27328	Cálculo de Máquinas	1st	6	A	➡
26047	Tecnología Mecánica	2nd	6	A	➡
27322	Cálculo Elástico de Sólidos	2nd	6	M	
Bachelor's Degree in Telecommunications Engineering					
27359	Arquitectura de Redes y Servicios de Telecomunicación	Annual	9	A	
27308	Fundamentos de Ciencia de los Materiales	1st	6	A	➡
27352	Automatización y Comunicaciones Industriales	1st	4,5	A	➡
27360	Electrónica de Circuitos	1st	6	M	
27373	Comunicaciones ópticas	1st	4,5	A	➡

[1] SEMESTER: Annual: September 2024 to May 2025
1st: September 2024 to January 2025
2nd : January 2025 to May 2025
[2] SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30.

Universidad del País Vasco Euskal Herriko Unibertsitatea

FACULTY OF ENGINEERING – BILBAO					
	COURSE	SEMESTER[1]	CREDITS	SCHEDULE[2]	LINK TO SYLLABUS
27377	Redes y Servicios Móviles	1st	4,5	A	
27383	Laboratorio de Sistemas Digitales	1st	4,5	A	
27384	Análisis de Circuitos	1st	4,5	M	
27386	Antenas y Propagación	1st	4,5	A	
27389	Diseños basados en Microprocesadores	1st	4,5	A	
26850	Sistemas de alta frecuencia	2nd	6	M	
27347	Óptica Aplicada a las Telecomunicaciones	2nd	6	A	
27362	Despliegue y Gestión de Redes y Servicios	2nd	4,5	A	
27364	Laboratorio de Electrónica de Comunicaciones	2nd	4,5	A	
27365	Teoría de la Comunicación	2nd	7,5	A	
27374	Redes de Acceso	2nd	6	M	
27375	Redes de Transporte	2nd	6	M	
27376	Sistemas de Radiocomunicación	2nd	6	M	
27380	Servicios Telemáticos Avanzados	2nd	6	M	
27385	Campos Electromagnéticos	2nd	6	A	
27388	Radar y sistemas de navegación por satélite	2nd	4,5	A	
27390	Electrónica para la conversión de Energía	2nd	6	M	
27833	Circuitos de Telecomunicación	2nd	4,5	A	
Bachelor's Degree in Environmental Engineering					
27421	Reactores Químicos y Biológicos	2nd	6	M	
27440	Gestión Ambiental en la Industria	2nd	4,5	A	
Common courses in Technical and Industrial Engineering					
27682	Mecánica aplicada	Annual	9	A	
27684	Gestión de Proyectos	1st	6	A	
Bachelor`s Degree in Mechanical Engineering					
27720	Ampliación de Expresión Gráfica	1st	6	M	
27722	Elasticidad y Resistencia de Materiales	1st	9	M	
26621	Estructuras y Construcciones Industriales	2nd	9	M	
27724	Diseño de máquinas	2nd	9	M	
27728	Mecánica de Fluidos Computacional	2nd	6	A	

Universidad del País Vasco Euskal Herriko Unibertsitatea

FACULTY OF ENGINEERING – BILBAO

	COURSE	SEMESTER[1]	CREDITS	SCHEDULE[2]	LINK TO SYLLABUS
Bachelor's Degree in Industrial Electronics and Automation Engineering					
25996	Sistemas electrónicos digitales	2nd	6	M	
Bachelor's Degree in Computer Engineering in Management and Information Systems					
26025	Sistemas de Gestión de Seguridad de Sistemas de Información	1st	6	M	
27700	Estructura de Datos y Algoritmos	1st	6	A	
27709	Administración de Sistemas	1st	6	A	➡
27710	Aspectos Profesionales de la Informática	1st	6	M	➡
27711	Minería de datos	1st	6	A	➡
27706	Administración de Bases de Datos	2nd	6	M	
27712	Desarrollo Avanzado de Software	2nd	6	A	➡
27699	Introducción a las Redes de Computadores	2nd	6	A	
Bachelor's Degree in Civil Engineering					
27792	Infraestructura del Transporte	Annual	10,5	M	
26589	Ingeniería y Morfología del Terreno	1st	6	A	
26595	Ingeniería Ambiental	1st	6	A	➡
28357	Aplicaciones BIM en la Ingeniería Civil	2nd	4,5	A	
27783	Acústica y Control de Ruido para Obras Civiles	2nd	4,5	A	➡
27786	Sistemas de Información Geográfica	2nd	4,5	A	➡

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GITECI30 - Bachelor`s Degree in Industrial Technology Engineering **Year** Fourth year

COURSE

27323 - Engineering Projects **Credits, ECTS:** 6

COURSE DESCRIPTION

The subject "Engineering Projects" is a common subject that is given in the Degree of Engineering in Industrial Technology. The subject develops the capacity of the student to combine knowledge and attitudes acquired along the career to apply them in the develops of projects of engineering, having in counts especially the cost limitations, time, resources, organizational aspects, quality, risks and respect to the environment. Equally it develops the capacity of search of information. The topics of the theoretical part consist of exposing questions related to the managing and timing of projects of Engineering in its different phases. The practical part is about the application of the theoretical topics doing several individual and in group practices.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

M02R11.- Applied knowledge of business organisation.
M02R12.- Knowledge and skills to organize and manage projects. To know the organizational structure and functions of a project office.

Learning outcomes:
•Inclusion of environmental and sustainability considerations in the design of machines, processes and industrial installations
•Inclusion of economic and organisational considerations in the design of machines, structures, installations and industrial processes.
•Planning and drafting of projects for machines, structures, constructions, plants, processes and industrial installations.

Theoretical and Practical Contents

1.- THE PROJECT DEFINITION
2.-.PHASES AND DOCUMENTS OF THE PROJECT
3.- PROJECT ASSESSMENT
4. BASIC AND DETAILED ENGINEERING
5. PROJECT ORGANIZATION AND MANAGEMENT
6. PROJECT TIMING
7. TECHNICAL REPORTS
8. TECHNICAL PROCEDURES AND INDUSTRIAL LEGISLATION
9. METHODOLOGY OF PRODUCT DESIGN
10. ERGONOMICS
11. ECODESIGN
12. EVALUATION OF ENVIRONMENTAL IMPACT
13. ENVIRONMENTAL MANAGEMENT OF THE COMPANIES
14. QUALITY MANAGEMENT. THE QUALITY IN THE PROJECT
15. QUALIT COSTS. TOOLS FOR PROBLEM SOLVING
16. STANDARDISATION, ACCREDITATION AND CERTIFICATION
17.LABOR RISKS PREVENTION
18. SAFETY in THE PROJECT

TEACHING METHODS

The theoretical part will be given in the first quarter and it consists of master classes and the resolution of individual exercises to help the comprehension of the given matters. The practical part will be during the whole course: the students will work with different tools in the area of the Engineering Projects, and after will develop individual and in group works, where the adquired knowledge will be put into practice.

TYPES OF TEACHING

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

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 40%
- Exercises, cases or problem sets 60%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

THE STUDENT ASSESSMENT WILL BE DONE WITH NEXT WEIGHTING PROCEDURE: FINAL THEORY EXAM 40 %, PRACTICES 60 %. IT IS NECESSARY TO OBTAIN POSITIVE ASSESSMENT IN BOTH ASPECTS SEPARATELY. THE WITHDRAWAL TO CALL IS REALIZED NOT APPEARING TO THE EXAM, AND IT WILL CONSIST of "NOT PRESENTED". THE Final THEORY EXAM OF THE ORDINARY CALL WILL BE REALIZED IN JANUARY.
The practices will be evaluated by the ongoing evaluation method. The student is able to renounce to this method, by asking for a final exam, according to the current normative rules.
"In the event that health conditions prevent the realization of a face-to-face teaching activity and/or evaluation, a non-face-to-face modality will be activated of which the students will be promptly informed."

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

THE STUDENT ASSESSMENT WILL BE DONE WITH NEXT WEIGHTING PROCEDURE: FINAL THEORY EXAM 40 %, PRACTICES 60 %. IT IS NECESSARY TO OBTAIN POSITIVE ASSESSMENT IN BOTH ASPECTS SEPARATELY. THE WITHDRAWAL TO CALL IS REALIZED NOT APPEARING TO THE EXAM, AND IT WILL CONSIST of "NOT PRESENTED".
In the case that the student does not have done the practices by the method of on-going evaluation, he or she is able to ask, previous communication, for a final exam including both theory and practices, according to the current normative rules.
"In the event that health conditions prevent the realization of a face-to-face teaching activity and/or evaluation, a non-face-to-face modality will be activated of which the students will be promptly informed."

MANDATORY MATERIALS

The management of the subject will be necessarily across the platform egela.ehu

BIBLIOGRAPHY

Basic bibliography

- Otegi JR.,Toledo N.,Etxaniz O.,Zuazo I., Aretzaga J.: "De la idea al plan de proyectos en 10 pasos" Open Course Ware 2014 Disponible en: http://ocw.ehu.es/course/view.php?id=336
- J. Caamaño, "Elementos básicos de Ingeniería de Proyectos", Publicaciones de la ETSIB UPV/EHU, 2004
- H. Kerzner, "Project Management. A Systems Approach to Planning Scheduling and Controlling", Wiley, 2009
- PMI, "A guide to the Project Management Body of Knowledge (PMBoK) 6th edition", 2017
- A. González Marcos et. Al, "Ingeniería de Proyectos", Dextra Editorial, 2014 - Capítulo 7
- UNE 157001:2014 Criterios generales para la elaboración formal de los documentos que constituyen un proyecto técnico, 2014

Detailed bibliography

Journals

Web sites of interest

- PMI, https://www.pmi.org/
- IPMA http://www.ipma.world/
- AEIPRO https://www.aeipro.com/es/

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GITECI30 - Bachelor`s Degree in Industrial Technology Engineering **Year** Fourth year

COURSE

26047 - Mechanical Technology **Credits, ECTS:** 6

COURSE DESCRIPTION

MANUFACTURING TECHNOLOGY subject is taught in 4th Course Degree in Industrial Technology and is the introduction to advanced subjects dealing with manufacturing processes at the Faculty of Engineering of Bilbao.
The course introduces students to the capabilities of key manufacturing processes (machining, forging, casting ...) and machine tools and equipment necessary to perform them. In addition, given its link with manufacturing, special attention is given to measurement technologies (Dimensional Metrology). Within this context, the course aims to address the need for students to be able to justify what manufacturing processes could be used for the production of a certain component.
On the other hand, it is intended that students can describe the equipment and calculate the most important parameters of a particular manufacturing process, and propose, under clear reasons, orders of magnitude of the fundamental parameters.
Finally, it is also intended that students can describe the drive systems and control of the machines used in the manufacture of parts. All this taking as general context the importance of the industry and machine tool accessories in the Basque Country and surroundings.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

M02R9 specific competence: Basic knowledge of production systems and manufacturing.

From these competences the following learning outcomes are derived:
-To be able to integrate the design requirements of a component in the productive means available in a particular manufacturing plant.
-To be able to design components and sets of machine tools, as well as to address the modifications in them to extract the maximum productive yield of them.
-To be able to integrate the techniques of metrology and quality control in the production chain.
-To be able to optimize the machining, casting and plastic deformation processes.
-To be able to select and design the tools and equipment needed to manufacture a specific component.
-To be able to obtain the maximum added value for a given component through the selection of the most suitable process.
-To be able to understand the consequences of the material -manufacturing process interaction, valuing the modification of functional and service properties that can suffer a certain component after the forming operations.

Theoretical and Practical Contents

MODULE I. DIMENSIONAL METROLOGY
Lesson 1. Introduction to Dimensional Metrology
Lesson 2. Operational and instruments
Lesson 3. Metrology surface finish

MODULE II. FOUNDRY
Lesson 4. Sand Casting
Lesson 5. Development of sand casting
Lesson 6. Permanent mold casting

MODULE III. PLASTIC FORMING
Lesson 7. General
Lesson 8. The forging process
Lesson 9. Rolling
Lesson 10. Forming sheet
Lesson 11. Semi-continuous processes

MODULE IV. MACHINING
Lesson 12. Turning
Lesson 13. Milling
Lesson 14. Drilling
Lesson 15. Cutting Tools
Lesson 16. Grinding
Lesson 17. Numerical Control

MODULE V. OTHER TECHNOLOGIES

Lesson 18. Introduction to welding processes
Lesson 19. Additive Manufacturing
Lesson 20. Sintering

TEACHING METHODS

The teaching of the subject is articulated through the following instruments:

- Theoretical and practical classes (M and GA) taught in the classroom, where the teacher will explain the main concepts.

- Industrial workshop practices (TI): Students will be able to analyze the manufacturing processes of different workpieces, perform calculations corresponding to real problems and use instruments and machines similar to those that can be found in an industrial manufacturing workshop.

- Seminars (S): Students will be able to carry out calculations corresponding to machining problems to strengthen the knowledge acquired in the magistral lessons related to the machining module.

The contents of both the industrial workshop practices and the seminars are a necessary complement to the magistral lessons in order to establish the differences between different manufacturing processes and to observe real applications of these to industrial components. Given the importance of both, their content is a subject of examination, as well as the contents of magistral lessons (M) and classroom practices (GA). The industrial workshop practices and the seminars will be carried out by groups in the official schedules of the subject.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	30	6	15					9	
Horas de Actividad No Presencial del Alumno/a	45	9	22,5					13,5	

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 100%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

General features:
- All concepts taught in both theoretical and practical classes are subject to evaluation.
- The pass in the subject will be obtained with a grade equal to or greater than 5 in the corresponding call. In no case will evaluations be carried out outside the official published dates.
- Only those students who are officially enrolled in the subject may receive the evaluation of the subject.

The evaluation process consists of quantifying to what extent the students have assimilated the fundamental concepts of the subject. The evaluation of the subject is continuous and is made up of a set of written exams.

WRITTEN EXAMS (development and test)

The evaluation of the theoretical-practical part is carried out through a set of written exams. The evaluation system for the written exams is detailed below.

MIDTERM EXAM
Partial exam corresponding to the first three modules of the subject: Dimensional Metrology, Casting and Plastic Forming. It is an optional exam, whose weight on the ordinary call of the subject is 35%. The qualification required in order not to repeat it in the regular exam is 5.

REGULAR EXAM
It is an official exam. It consists of 4 parts:
1. Written exam corresponding to the last two modules of the subject: Machining by Chip Removal and Other Technologies. The weight on the final exam of the subject is 30%.
2. Numerical problem associated with module IV. The weight on the final exam of the subject is 25%.

3. Written exam corresponding to the Industrial Workshop Practices (PTI). The weight on the final exam of the subject is 10%.
4. Written exam corresponding to the first three modules of the subject: Dimensional Metrology, Casting and Plastic Forming. The weight on the final exam of the subject is 35%. This part will not be compulsory if the midterm exam has been passed.

If this call is failed, the complete exam should be taken in the extraordinary call.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

It is an official exam which consists of 4 parts:
1. Written exam corresponding to the first three modules of the subject: Dimensional Metrology, Casting and Plastic Forming. The weight on the final exam of the subject is 35%.
2. Written exam corresponding to the last two modules of the subject: Machining by Chip Removal and Other Technologies. The weight on the final exam of the subject is 30%.
2. Numerical problem associated with module IV. The weight on the final exam of the subject is 25%.
3. Written exam corresponding to the PTI. The weight on the final exam of the subject is 10%.

The student has to take all the parts in order to pass the exam.

MANDATORY MATERIALS

Teaching Guide available for free on the platform of Virtual Teaching at the UPV / EHU Student Guide, Course notes, Sheets practices and general information.

BIBLIOGRAPHY

Basic bibliography

•American Society for Metals; Casting Design Handbook; American Society for Metals (ASM), 1962
•Beeley, P.R.; Foundry Technology; Butterworth-Heinemann, 2001
•American Society for Metals; Powder Metal Technologies and Applications ASM Handbook, Vol. 7, 1998
•Byrer, T.G., Semiatin, S.L., Vollmer, D.C.; Forging Handbook; Forging Industry Association/American Society for Metals, 1985
•Wick, C., Benedict, J.T., Veilleux, R.F.; Tool and Manufacturing Engineers Handbook. Vol 2. Forming; SME, 1984
•American Welding Society, Welding handbook, varios volúmenes.
•Jeffus, L., Welding. Principles and applications, Delmar Publishers, Inc., 1993.
•Davim, J. Paulo (Ed.); Machining Fundamentals and Recent Advances; Springer 2008.
•Metals Handbook. 9th Ed. Vol 16 Machining; ASM International, 1989
•Boothroyd, G., Knight, W.A.; Fundamentals of Machining and Machine tools, 2nd edition; Marcel Dekker, 1989.
•Arnone, M.; Mecanizado de alta velocidad y gran precisión. El Mercado técnico SL, 2000.
•Dotson C. L.; Fundamentals of Dimensional Metrology; Delmar Cengage Learning, 2006
•Farago, F.T.; Handbook of Dimensional Measurement. Industrial Press, 1982

Detailed bibliography

•Lopez de Lacalle, L.N.; Lamikiz, A. (Eds.); Machine Tools for High Performance; Springer 2009.
•Bucher J. L.; The Metrology Handbook; ASQ Quality Press, 2012.
•Casting Design Handbook; American Society for Metals (ASM).
•Campbell, J.; Castings; Butterworths-Heinemann, 1991.
•Byrer, T.G., Semiatin, S.L., Vollmer, D.C.; Forging Handbook; American Society for Metals (ASM).
•Pearce, R.; Sheet Metal Forming. Adam Hilger, 1991.
•Metals Handbook, 9th edition, vol. 14. Forming and forging. ASM International.
•López de Lacalle, L.N., Sánchez, J.A., Lamikiz, A.; Mecanizado de alto rendimiento: Procesos de arranque. Ediciones Técnicas Izaro, 2004
•Kieff, H.B. Manual de CNC. Gran Duc. 1998
•Galyer J.F.W., Shotbolt, C.R.; Metrology for engineers. Cassell Publishers Limited, 1990.

Journals

Scientific journals with articles directly related to the subject content and accessible from the library of the University of the Basque Country UPV/EHU.

* Advanced Materials and Processes.
* Annals of the International Institution for Production Engineering Research (CIRP).
* IMHE (Información de Máquinas-Herramienta, Equipos y Accesorios).
* International Journal of Machine Tool and Manufacture
* Journal of Engineering Materials & Technology.
* Journal of Material & Processing Technology.
* International Journal on Production Research.

Web sites of interest

www.ehu.es/manufacturing
www.engineershandbook.com
www.moderncasting.com/
www.forjas.org
www.euroforge.org/
www.afm.es
www.coromant.sandvik.com/es
www.cem.es

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GITECI30 - Bachelor`s Degree in Industrial Technology Engineering **Year** Fourth year

COURSE

27325 - Structural Materials: Behaviour in Service and Mechanics of Fracture **Credits, ECTS:** 6

COURSE DESCRIPTION

Based on the fundamental knowledge of Materials Science, acquired in the second year, this course contributes to deepen the knowledge about the properties and behavior of structural materials, understood as those materials that are used to produce components subjected to different mechanical demands, both in machinery and in structures. This course will be of general interest for several engineering disciplines and branches, including the completion of the final degree projects on Industrial Engineering.

The first part of the course delves into the nature, properties and processing of structural materials, with special focus on the relationship between the mechanical behavior, the microstructure and the processing conditions of metallic materials. The relevant aspects related to the use of polymeric, composite and ceramic materials for structural functions are also approached. On the second part, the course immerses into the study of failure mechanisms in service conditions, including the bases of Linear Elastic Fracture Mechanics and its use in design and product engineering, the fundamentals of the Elastic-Plastic Fracture Mechanics, the application of both disciplines in the analysis and forecasting of fatigue and stress corrosion failure, as well as the fundamentals of creep (plastic) failure of materials at high temperatures.

The curriculum for the degree integrates this course with the rest of the courses considering the expertise and skills that the students should exhibit to approach it, and those which the course aims to provide. Vertically, it has been implemented in the 4th year, coordinated with various courses from previous years where the students acquire the expertise and skills required as a starting point for this course. The horizontal coordination of the course with other courses settled on the 4th year of the degree renders a reasonable activities-schedule for the students and also includes the coordination of the contents with several other courses, which introduce and use similar concepts and principles, such as the courses on Machine Elements, Calculation of Machines and Theory of Structures.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Capacity to address developments, projects and advanced studies in the field of materials engineering with a high degree of autonomy.
Find and select information, written and oral communication skills, writing report and projects, documentation management.

Theoretical and Practical Contents

Lesson 1. Presentation and Introduction. Types of materials against mechanical behavior. Crystal structure. Elastic deformation and theoretical resistance. Non-crystalline structure. No elastic deformation.
Lesson 2. Structural Materials. Introduction to Physical Metallurgy. Hardening mechanisms metal alloys. Alloying and shaping materials.
Lesson 3. Iron-Carbide alloys . Diagrams, microstructures and thermal treatments.
Lesson 4. Steels and cast irons. Structural steels. Alloyed steels for strength, carburizing, nitriding. High-strength steels. Cast irons. Aluminum and titanium alloys. Non-ferrous metals.
Lesson 5. Polymeric and composite materials. Thermoplastics. Thermosets. Elastomers. Combining and modifying polymers.
Lesson 6. Ceramics and glasses. Ceramic materials. Concretes. Glasses. Refractories. Tribology.
Lesson 7. Fracture mechanics. Energy approach. Tensional approach and linear elastic fracture. Plane stress and plane strain. Anisotropic materials. Dimensional stress states. Fracture against plastification.
Lesson 8. Toughness tests. macro and microscopic aspects of fracture in materials. Mechanics of elastic-plastic fracture. CTOD. J integral. HRRFields.
Lesson 9. Fatigue of materials. Effects of cyclic loading. Fatigue tests. physical nature of fatigue damage. S-N curves. Design fatigue. Fatigue crack growth. Paris’ law.
Lesson 10. Creep and dissipation in materials. Creep tests. Physical mechanisms of creep. Creep crack growth. Estimate component life. Stress-strain-time curves. Energy dissipation in materials.
Lesson 11. Corrosion and corrosion resistant materials. Corrosion. Stress corrosion. Fatigue corrosion. Crack growth. Corrosion resistant materials.

TEACHING METHODS

The course employs four teaching modalities: lectures, exercise-classes, seminars and laboratory practices.

In practice, the lectures and exercise-classes take place in joint sessions where extensive explanations will be given by the teacher and, examples and exercises, will be approached together with the students. The documents to study the syllabus and to approach the exercises are available in eGela, as well as in the reprography service of the EIB. eGela will also include the activities and tasks scheduled as non-classroom work for the students, as well as other additional

material suitable to approach the course.

The seminars will focus on specific topics, where students will advance their expertise by means of teamwork and occasional debates around case studies. In this way, the syllabus-contents about those topics is attained in a practical and applied way.

In the laboratory practices, a small team project will be developed. It entails experimental work in the metallurgy-laboratory in order to acquire knowledge and expertise about experimental techniques, as well as analysis and decision-making skills.

In the event that minimum distances between students are established for health-safety reasons, the practices will be organized on a delegated basis and, likewise the rest of the teaching modalities, the conditions indicated by the EIB management team will apply. Also, in the event that face-to-face assessment cannot be carried out, the pertinent changes will be made to carry out an online evaluation by using the existing computer tools at the UPV/EHU. The characteristics of this online evaluation will be published in eGela.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	37,5	7,5	7,5	7,5					
Horas de Actividad No Presencial del Alumno/a	56,25	11,25	11,25	11,25					

Legend:

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 40%
- Exercises, cases or problem sets 20%
- Teamwork assignments (problem solving, Project design) 25%
- PRACTICAS DE LABORATORIO 15%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A continuous assessment methodology will be used, with several activities and tasks. The weighting will be as follows:

-Final assessment test, including exercises and theoretical questions: 40% of the final grade.

Syllabus content comprehension and expertise in solving practical exercises. Assessment of the skills for autonomous work.

- Completion of various tasks and activities throughout the course: 20% of the final grade. Achievement degree of several syllabus topics (theoretical background and practical exercises).

- Written reports, poster presentations and oral communication of the work carried out in the Seminars: 25% final grade.

Assessment of the skills and expertise to use theoretical and practical knowledge to solve open problems and case studies.

Assessment of the skills and expertise for teamwork by presenting proposals, analyzing other members´contributions, discussing ideas and executing pertinent actions. Interpersonal skills.

-Writing a report and a visual presentation about the Laboratory project, and presenting it face to face to the class: 15% of the final grade.

Assessment of the skills to approach a poorly defined task, which needs to develop a plan for the required steps, to execute them experimentally, to analyze critically the obtained results, to propose solutions and to communicate them, both in writing and orally. All of it as part of a team.

It is compulsory to carry out all the tasks, tests and activities scheduled in the continuous evaluation. A score above 5 out of 10 must be obtained in each of them. Exceptionally, students may pass with a Final assessment test score higher than 4.5 out of 10, as long as the rest of the activities and tests evaluated in the course have a grade higher than 5 out of 10.

Students have the right to waive the continuous assessment and opt for the assessment according to one single final assessment test. The students who choose this option must inform the lecturer before week 9th.

Students who opt the final assessment must sit the final exam in date and time stablished. In this case, the final test will contain questions and exercises regarding all the topics and aspects approached along the course in all the teaching modalities.

The students have the right to revoke the assessment of the current course. No notification to the lecturer is required in that case. By default, any student who does not take the final assessment test revokes the assessment of the course.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A final assessment test will be held for 100% of the final mark. It will contain questions and exercises questions and exercises regarding all the topics and aspects approached along the course in all the teaching modalities.

Students who, having done continuous assessment during the ordinary assessment period, passed all the assessed activities except for the final assessment test, may choose to keep the grade obtained in those activities. In that case, a final assessment test in the extraordinary call will be 40% of the final grade, as long as the minimum grade obtained in it is 4 out of 10.

By default, the students who do not take this final assessment test revoke the assessment of the course.

MANDATORY MATERIALS

eGela

Notes of the Course

Book of exercises

BIBLIOGRAPHY

Basic bibliography

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- Deformation and Fracture Mechanics of engineering Materials, John Wiley & Sons, Inc. (2013)

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--D. Scott MacKenzie, George E. Totten - Analytical Characterization of Aluminum, Steel, and Superalloys-CRC Press (2005) - M.J. Donachie, Superalloys: a Technical Guide, 2nd edittion, ASM International, (2002) - M.Avedesian and H. Baker, Magnesium and Magnesium Alloys, ASM International, (1999) -Anderson, T.L., Fracture Mechanics,

Fundamentals and Applications. 4th Edition, CRC press (2017) -Hertzberg, Deformation and Fracture Mechanics of engineering Materials,John Wiley & Sons, Inc. (2013) -Wolfgang Grellmann, Deformation and Fracture Behaviour of Polymer Materials,Springer International Publishing (2017) - ASM Handbook. Volume 8. Fatigue and Fracture. ASM Internacional. (2000)

Journals

-Revista de Metalurgia del CENIM

-Scripta Materialia

-Materials and Design

Web sites of interest

http://products.asminternational.org/hbk/index.jsp http://www.sciencedirect.com/ https://www.doitpoms.ac.uk/miclib/index.php https://dl.asminternational.org/handbooks/pages/Handbooks_by_Volume https://matweb.com/ https://www.steel.org/steel-technology/

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GITECI30 - Bachelor`s Degree in Industrial Technology Engineering **Year** Fourth year

COURSE

27328 - Machine Calculation **Credits, ECTS:** 6

COURSE DESCRIPTION

In this course, main methods of machines design are presented. Also, the integration of these methods into the production scheme of a company in order to increase the quality and profitability of their products is studied.

The mechanical design and analysis is a classic mechanical engineering task. It involves obtaining a component, assembly, machine or structure based on the required technical specifications, using generally qualitative and subjective criteria, based on experience and company. Calculations in this phase, if any, such as kinematic and dynamic resistant, thermal, etc., are usually relatively simple and merely indicative, without going into detail. The working tool is a program of computer-aided design, CAD (Computer Aided Design).

In design tasks, apart from experience, the engineers mainly use their knowledge of subjects such as technical drawing, geometry, applied mechanics, machine parts, construction elements, manufacturing technologies, different standards and engineering projects.

Once a component, assembly, machine or structure has been designed, analysis techniques try to simulate its mechanical behaviour in service. Today, in the analysis phase, the computer is widely used, with programs mainly based on finite element techniques, FEA (Finite Element Analysis) and others similar.

In this phase, the engineer uses his expertise on kinematics and dynamics, elasticity and mechanics of materials, thermodynamics, fluid mechanics, fatigue, methods of computational analysis, theory of structures and specific knowledge of the type of machine or structure that he is designing and corresponding calculation standards and protocol of the company in its case.

If necessary, later, prototypes are built and are tested. The results of these tests can be used, at least in part, to improve analysis. Machine Design classes, the knowledge that the student has on materials, elasticity, mechanics of materials and other current and calculation methods are expanded. And actual calculation methods to be able to carry out the analysis of complex mechanical resistant components are presented.

Also in this matter, aspects of specimens and prototypes tests, especially in the field of fatigue problems are studied.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Competences of the subject:

- Knowledge and ability for calculation, design and testing machines.

- Ability to deal developments, projects and advanced studies in the field of mechanical engineering, with a high degree of autonomy.

Learning outcomes:

- Design by finite element method.

- Fatigue failure design.

- Search and select information, communicate orally or in writing, writing reports.

Theoretical and Practical Contents

Presentation of the subject
1. Scope of the subject Machine Design
2. Relationship with other subjects in the curriculum; background
3. Subject program
4. Organization of the course; lectures, tutorials, labs, exams

Chapter 1

A first description of the MEF and its use in mechanical design
1. Product Development Cycle
2. Brief historical description and MEF bases
3. Functions of interpolation, natural coordinates and approximate solution.
4. Basic relations in an element
5. Calculation of the stiffness matrix of an element
6. Stiffness matrix model, boundary conditions, properties

Chapter 2
Analysis of two-dimensional models

1. Types and applications of two dimensional analysis in machine design
2. Properties and applications truss and beam elements
3. Triangular and quadrilateral linear element
4. Other elements; higher order and transition

Chapter 3
Analysis of three-dimensional models
1. Overview of three-dimensional analysis
2. Elements bar and beam
3. General considerations on the solid elements
4. Finite element models of plates and shells

Chapter 4
Mechanical properties and material selection

1. Selection of materials
2. Qualitative Properties
3. Quantitative Properties
4. Local effects; stress concentration
5. Stress concentration coefficients
6. Factors that contribute brittle failure in ductile materials

Chapter 5
Safety factor and failure theories in machine design

1. Necessity of the safety factor
2. Influence of material and method of analysis
3. Selection of safety factors
4. Theories of static failure in machine design

Chapter 6
Introduction to material fatigue

1. Analysis with variable solicitations: quasi-static and dynamic cases
2. Background and current status
3. Qualitative aspects of fatigue
4. Fatigue tests

Chapter 7
Material fatigue with uniaxial alternating stresses
1. Theories for fatigue analysis
2. Resistance to fatigue and fatigue limit
3. Modifying factors of fatigue limit
4. Stresses concentration and notch sensitivity
5. Modifying factors for finite life; Basquin equation

Chapter 8
Fatigue analysis with nonzero mean stress

1. Fatigue with mean stresses; Haigh diagram
2. Criteria for the Haigh diagram in ductile materials

3. Criteria for the Haigh diagram in brittle materials
4. Safety factor; equivalence stresses
5. Safety margin; equivalence duration
6. Treatment of stress concentration

Chapter 9
Cumulative damage

1. Cumulative Damage: Palmgren-Miner method
2. Cumulative Damage: modification of Manson
3. Procedures for cycle counting

Chapter 10
Fatigue analysis with multiaxial stress

1. General considerations on multiaxial fatigue
2. Multiaxial simple state with alternating stresses
3. Multiaxial simple state with nonzero mean stresses
4. Classic treatment of complex multiaxial states
5. Methods for global approach and critical plane

Chapter 11
Linear Fracture Mechanics for Fatigue
1. Basic concepts of fracture mechanics
2. Fatigue crack propagation; applying Paris equation
3. Delay effects caused by overload
4. Prediction of crack growth

Computer practices (PO)

Chapter PO1
Practical considerations about finite element programs
1. Organization of a Finite Element program
2. Outline of use of computer program
3. A basic example of modeling

Chapter PO2
Analysis of two-dimensional models
1. Examples with truss and beam elements
2. Examples with two-dimensional elements: plane stress, plane strain, axisymmetric
3. Examples with combination of different types of 2D elements

Chapter PO3
Analysis of three-dimensional models
1. Examples with truss and beam elements
2. Examples with solid elements
3. Examples shell elements
4. Examples with combination of different types of 3D elements

Chapter PO 4
Test and fatigue design practice
1. Computer programs for fatigue analysis
2. Fatigue design using finite element method
3. Comparison and practical considerations

TEACHING METHODS

The course consists of lectures, classroom practices and computer practices.

1. Lectures

It is the fundamental part of the subject, teachers expose classroom lessons interacting with students. For the successful use of these classes, students will have previously basic information corresponding to the lesson taught. Classes are primarily based on developments made on the board with computer presentations.

2. Classroom practices
Troubleshooting and practical approach to learning to select the most appropriate design method to each case and apply the methods and calculation procedures outlined in the theory classes and practical method of computer cases.

3. Individual and group tutorials
The tutorial classes serve to elucidate and reinforce those aspects of the subject that need the student, after attending class and done prior study work. The teachers of the subject will be available in the hours devoted to tutoring published in the GAUR application of the UPV / EHU. The place for tutoring will be the office of each professor in the Department of Mechanical Engineering of Bilbao ETSI

4. Virtual Teaching Platform
On the platform egela-EHU is available to the students notes and miscellaneous information to facilitate monitoring of the course. Specifically, the Student Guide, scripts computer practices, exams of previous years are published. Likewise, the establishment of forums will be promoted to encourage student participation and facilitate cooperative learning

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	30		7,5		22,5				
Horas de Actividad No Presencial del Alumno/a	45		11,25		33,75				

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 75%
- Teamwork assignments (problem solving, Project design) 25%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students will have the opportunity to be evaluated through a single exam, according to the official call. A minimum mark of 5 points out of 10 will be required to pass the subject. In no case will the final exam be held out the official published date. The exam will have 3 tests. The first test will evaluate the knowledge acquired by the student in the first part of the subject, and will have a weight of a 30% over the final mark. The second test will evaluate the knowledge acquired by the student in the second part of the subject, and will have a weight of a 45% over the final mark. The third test will evaluate the knowledge acquired by the student in the computer practices, and will have a weight of a 25% over the final mark.
In the ordinary call, students will also have the opportunity to choose a continuous evaluation according to the next criterion:
- Mid-term exam:
· Weight over the final mark: %30.
· Content: first part of the subject.
· Minimum grade: 3,5 out of 10.
- Final exam:
* If more than 3,5 in the mid-term exam:
· Weight over the final mark: %45.
· Content: second part of the subject.
· Minimum grade: 3,5 out of 10. The average with the mid-term exam must be greater than 5 out of 10 to pass the subject.
* If less than 3,5 in the mid-term exam or to improve previously obtained mark (the mark of the mid-term exam would not be considered in this case):
· Weight over the final mark: %75.
· Content: the whole subject.
· Minimum grade: 5 out of 10.
- Team work:
· Weight over the final mark: %25.
· Content: a design or analysis study of a component using the Finite Element Method. Fatigue analysis methods can also be used.
· Minimum attendance: %80 of the computer classes.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary call, students will be evaluated through a single exam, according to the official call. A minimum mark of 5 points out of 10 will be required to pass the subject. In no case will the final exam be held out the official published date. The exam will consist of a single test, which will include the contents taught both in the theoretical and computer classes.

MANDATORY MATERIALS

Regarding the support material for the theoretical content, in the Library of the Engineering School, the student has a very extensive bibliography of consultation on the topics covered in this subject; those students who wish, have available in the Publications Service of the Engineering School the books entitled: " MÉTODOS DE ANÁLISIS PARA DISEÑO MECÁNICO: Vol. II." and " MÉTODOS DE CÁLCULO DE FATIGA PARA INGENIERÍA" Paraninfo publisher. For class problems there are notes in the Publications Department of the School: " CUADERNO DE EJERCICIOS DE CLASE: TECNOLOGÍA DE MATERIALES Y DISEÑO DE MÁQUINAS ". Also, on the website, http://egela.ehu.es, computer practices about finite element method, some figures, previous exam, photographs of interest, links to other pages and content of computer practices are linked.

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Basic bibliography

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MÉTODOS DE CÁLCULO DE FATIGA PARA INGENIERÍA. R. Aviles. Ed. Paraninfo. ISBN 9788428335188
CUADERNO DE EJERCICIOS DE CLASE: TECNOLOGÍA DE MATERIALES Y DISEÑO DE MÁQUINAS. Servicio Publicaciones ETSI Bilbao

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Rothbart, H.A.; Mechanical design & systems handbook 2a Ed.. Mc Graw Hill, (USA), 1985.
Mott, R.L.; Diseño de elementos de máquinas, 2ª Ed.. Prentice may, (Mex), 1992.
Juvinall, R.C.; Marshek, K.M.; Fundamentals of machine component design (3rd Edition). Ed. Wiley, 2000.
Pilkey, W.D.; Peterson's Stress Concentration Factors, 2nd Ed. Wiley Interscience, 1997.
Dowling, N.E.; Mechanical Behavior of Materials: Engineering Methods for Deformation, Fracture, and Fatigue, 2nd Ed. Prentice-Hall, 1999.
Broek, D.; Elementary engineering fracture mechanics. Martinus Nijhoff Publishers, Kluwer Academic Publishers Group, 1984.
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Stephens, R.; Fatemi, A.; Stephens, R.R.; Fuchs, H.O.; Metal Fatigue in Engineering, 2nd edition. Wiley, 2001.
Zienckiewicz, O.C.; The finite element method (3' Ed.). Mc Graw-Hill, 1985.
Hughes, T.J.R.; The Finite Element Method; Linear Static and Dynamic Finite Element Analysis. Prentice-Hall International Editions, 1987.
Rao, S.S.; The Finite Element Method in Engineering. Pergamon International Library, 1982.
Avilés, R.; Métodos de Análisis para Diseño Mecánico, Vol. III: Elementos Finitos en Dinámica. Departamento de Publicaciones de la ETSI de Bilbao, 2002.

Journals

International Journal of Fatigue

Finite Elements in Analysis and Design

Web sites of interest

www.ingenierosbilbao.com
www.biblioteka.ehu.es
http://www.efatigue.com/
http://www.journals.elsevier.com/international-journal-of-fatigue/

OBSERVATIONS

In the event that the sanitary conditions prevent the face-to-face teaching activity and/or evaluation, a non-face-to-face modality will be activated. In this case, the students will be informed promptly.

Universidad del País Vasco Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27308 - Fundamentals of Materials Science **Credits, ECTS:** 6

COURSE DESCRIPTION

This subject includes the basic knowledge of Materials Science normally taught in European Engineering degrees comparable to it. The first lessons deal with topics such as the growing importance of materials in engineering, the basic structure of the materials of the different classical families (metals, ceramics, polymers), and the transformations that occur or can take place in their manufacture and their normal use. Afterwards (lessons 6 to 9) the most important structural materials are studied, starting with the study of the most relevant mechanical properties to continue with a brief description of the materials most used today among the three classic families along with the usual criteria used for their selection. In the final part (units 10 to 13) the so-called functional materials are introduced, a category that encompasses the materials used in the electrical, electronic, computer and telecommunications industries. In these last lessons the electrical, magnetic and optical behavior of materials is studied, in addition to the phenomenon of superconductivity. At the end of each chapter a brief description of the most important materials used in the different functional applications is provided. Likewise, in the seminars corresponding to this last part of the subject, some applications of nanomaterials will be introduced, given their growing relevance in the technological sectors related to the degree in telecommunications egineering.

The subject allows students to begin their training in the field of engineering materials and to generate concerns on the future graduates to complete the knowledge of this side of their training as engineers, which today is of the utmost relevance in the profession.

The mechanisms that guarantee horizontal coordination, within the course, are based on the coordination of the programs of this subject with others that introduce and use similar concepts and principles, such as Electronic Systems Technology and Optical Communications.

The mechanisms that guarantee vertical coordination are associated with the structuring of the complete Study Plan itself, so that the precise subjects needed to follow this one are already taught (Physics, Basic Electronics, Electronic Circuits and Devices, and Physics Extension).

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

INSTRUMENTAL
Capacity for analysis and synthesis
Organization and planning capacity
Oral and written communication
Ability to manage information
Problem resolution
Decision making

PERSONAL
Teamwork
Skills in interpersonal relationships
Critical thinking

SYSTEMIC
Autonomous Learning
Creativity
Leadership
Initiative

Theoretical and Practical Contents

LESSON 1. History and importance of Materials.
Science and engineering of materials. Historical perspective. Current trends in the use of materials

LESSON 2 The atomic structure and the chemical bond.
Fundamentals of atomic structure. Electronic models. Energy levels and electronic configurations. The Periodic Table. Bond forces and energies. Atomic bonds: ionic, covalent, metallic, secondary. Mixed bonds.

LESSON 3 The crystalline structure of solids.
The crystal order. Bravais networks. Miller indices. Metallic crystal structures. Other crystal structures. X-ray diffraction.

LESSON 4 Real solids and diffusion.
Defects in the solids. Point defects. Linear defects. Surface defects. Determination of grain size. The amorphous state: polymers and glasses. Thermal behavior of crystalline materials and amorphous materials. Solid state diffusion. Mathematical laws of diffusion. Diffusion coefficient. Industrial processes.

LESSON 5 Phase Diagrams.
Definitions. Solid solutions: Hume-Rothery rules. Gibbs phase rule. Types of phase diagrams: pure substances, binary. Total solubility binary diagrams. Binary diagrams with invariant points: eutectic, peritectic, monotectic. Diagrams with phases and intermediate compounds.

LESSON 6 Mechanical properties of materials.
Introduction. Elastic deformation. Plastic deformation. Tensile properties and stress-strain diagram. Influence of temperature and strain rate. Modeling of behavior in tensile tests. Hardness. Fracture and Charpy test. Fatigue. Creep.

LESSON 7 Metallic materials.
Ferrous materials: Manufacture of steels and cast irons. Types of steel: metal construction, stainless, tool steels. Types of cast irons. Aluminum and its alloys. Copper and its alloys. Titanium and its alloys. Other non-ferrous alloys. Thermal treatments of metallic materials.

LESSON 8 Polymeric and composite materials.
Polymer structure. Molecular weight distribution. Families of polymeric materials. Shape, structure and molecular conformation. Crystallinity in polymers. Mechanical behavior of polymers. Viscoelasticity. Fracture. Thermoplastic, thermosetting and elastomeric polymers. Manufacturing. Additives. Composite materials. Reinforcing fibers and particles. Laminar and structural compounds.

LESSON 9 Ceramic materials.
Obtaining and properties. Classic ceramics: bricks, tiles, porcelain, earthenware, stoneware. Technical ceramics: alumina, zirconia, silicon carbide, silicon nitride. Glasses: Manufacturing, properties and applications. Vitroceramics: properties and applications.

LESSON 10 Electrical properties. Semiconductor materials.
Electrical conduction in metals. Ohm's law. Band theory. Microscopic model of conduction. Matthiessen's rule. Electrical conduction in semiconductors. Intrinsic and extrinsic semiconductors. Band theory. Fermi level. Hall effect. p-n junction. Dielectric properties: capacitance, dielectric constant and polarization. Applications of dielectric materials. Ferroelectric and piezoelectric materials. Applications.

LESSON 11 Magnetic Properties.
Introduction. Microscopic origin of magnetism. Magnetic field intensity. Magnetic susceptibility and permeability. Diamagnetism. Paramagnetism. Ferromagnetism. Antiferromagnetism. Ferrimagnetism. Hysteresis. Structure of the magnetic domains. Hard and soft magnetic materials. families and applications. Hard and soft ferrimagnetic materials. families and applications.

LESSON 12 Superconducting Materials (SC).
Historical introduction. Perfect conductor and perfect diamagnetic. Meissner effect. Magnetic levitation. SC type I. BCS theory and Cooper pairs. Critical field and critical current. SC type II. High temperature SC. Irreversible field. SC materials and applications.

LESSON 13 Optical properties.
Introduction. Light and the electromagnetic spectrum. Light refraction Absorption, transmission and reflection. Luminescence. Lasers. Optical fibers.

TEACHING METHODS

In the master classes, extensive explanations will be given by the teacher with the help of the projection of the presentations, that will also be available to the students both electronically in the virtual classroom (eGela) and printed in the reprography service of the center.

In the seminars, teaching will be focused on specific topics that require complementary exercises to encourage teamwork and student participation with occasional debates. In this way it is possible to deepen the theoretical knowledge of the subject in a more practical and application focused way.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	37,5	7,5	15						
Horas de Actividad No Presencial del Alumno/a	56,25	11,25	22,5						

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 50%
- Multiple choice test 20%
- Exercises, cases or problem sets 30%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

MIXED EVALUATION: continuous (30%) and global exam (70%)

CONTINUOUS EVALUATION (30% of the final grade). Tasks solved in the Seminar classes (20%), and an individual exercise (10%) to be solved in classroom practice classes with the help of notes will be valued.

GLOBAL EXAM (70% of the final grade). The written exam will consist of a theoretical part and a practical part. The theoretical part is multiple choice (20% of the final grade) and the practical part consists of three exercises (50% of the final grade). It is allowed to bring printed information to the exam (subject notes, books, etc.), but it is not allowed to bring electronic devices.

Students may waive the mixed evaluation system and opt for the final evaluation. To do this, the interested student must submit a refusal write to the teacher within a period of 10 weeks from the beginning of the course. In this case they will be evaluated only through the final exam (100% of the grade)

In the event that a face-to-face evaluation of the subject cannot be carried out, the pertinent changes will be made to carry out an online evaluation through the use of the existing computer tools at the UPV/EHU. The characteristics of this online evaluation will be published on eGela.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The written exam will consist of a theoretical part and a practical part. The theoretical part is multiple choice (30% of the final grade) and the practical part consists of three exercises (the remaining 70% of the exam grade). It is allowed to bring printed information to the exam (subject notes, books, etc.), but it is not allowed to bring electronic devices.

Evaluation:
- Written exam: 100%

In the event that a face-to-face evaluation of the subject cannot be carried out, the pertinent changes will be made to carry out an online evaluation through the use of the existing computer tools at the UPV/EHU. The characteristics of this online evaluation will be published on eGela.

MANDATORY MATERIALS

- Course Slides.
- Book "Materials Science and Engineering: An Introduction". 10th ed. W.D. Callister. Wiley. (2018)

BIBLIOGRAPHY

Basic bibliography

- Introducción a la Ciencia de Materiales para Ingenieros. J.F. Shackelford. Ed. Pearson. (1998)
- Ciencia e Ingeniería de los Materiales. D.R. Askeland. Ed. Thompson.(2003)
- Fundamentos de la Ciencia e Ingeniería de Materiales. W.F. Smith. Ed. McGraw-Hill Science. (2009)

Detailed bibliography

- Materiales para ingenieros 1. Introducción a las propiedades, las aplicaciones y el diseño. M.F. Ashby. Ed. Reverté. (2008)
- Materiales para ingenieros 2. Introducción a la microestructura, el procesamiento y el diseño. M.F. Ashby. Ed. Reverté. (2008)

Journals

- Revista de Metalurgia del CENIM (revistametalurgia.revistas.csic.es)
- Boletín Cerámica y vidrio (boletines.secv.es)

Web sites of interest

www.doitpoms.ac.uk
www.msm.cam.ac.uk
ocw.mit.edu/courses

Throughout the course, additional links of specific interest will be provided for each topic.

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27347 - Optics Applied to Telecommunications **Credits, ECTS:** 6

COURSE DESCRIPTION

a) In this course the basic theory of both physical optics and geometrical optics is developed with a clear projection to the development of optical systems typical of telecommunication engineering. Starting from electromagnetic waves, classical themes of wave optics (interference, coherence, diffraction, polarization ...) and geometrical optics are analyzed. The course also includes more applied topics, such as imaging, optical modulation, and radiation detection.

b) Knowledge in optics is essential nowadays, where the new information and communication technologies incorporate a very high percentage of advanced optical technologies.

c) There will be a course coordinator and will coordinate with other courses coordinators.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The course covers the competence related to Optics included in the optional subjects module: comprehension of advanced concepts of Optics and their application in the development and management of optical systems typical of telecommunication engineering .

The learning outcomes that students are expected to achieve at the end of the semester are:

- To demonstrate detailed understanding of the basic concepts related to the laws of Optics as well as their application for the reasoned solving of problems of Telecommunication Engineering.

- Mastery of optical instrumentation, acquiring sufficient autonomy for its use and the realization of measurements.

- Management of basic techniques for the measurement and treatment of data and evaluation of experimental errors related to optical phenomena as well as the preparation of a report of a laboratory practice.

Theoretical and Practical Contents

CONTENTS

CHAPTER 1: ELECTROMEGNETIC WAVES
CHAPTER 2: INTERFERENCE
CHAPTER 3: COHERENCE
CHAPTER 4: DIFFRACTION
CHAPTER 5: POLARIZATION
CHAPTER 6: GEOMETRICAL OPTICS
CHAPTER 7: OPTICAL INSTRUMENTS
CHAPTER 8: IMAGING
CHAPTER 9: OPTICAL MODULATION
CHAPTER 10: DETECTION OF OPTICAL RADIATION

TEACHING METHODS

In order to achieve the proposed objectives in this course, as they are described in the competences that the student must acquire, some of the teaching methodologies established by university regulations will be combined: lectures, classroom practices and laboratory practices.

Theoretical developments, solving exercises, teaching experiences including computer demonstrations and laboratory practices are carried out.

In the event that sanitary conditions prevent the realization of a teaching activity and / or face-to-face evaluation, a non-face-to-face modality will be activated of which the students will be informed promptly.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	30		15	15					
Horas de Actividad No Presencial del Alumno/a	45		22,5	22,5					

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

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

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A) The following tools will be used for continuous evaluation:

- A final exam that will include the resolution of exercises and the development of a theoretical topic:
The following will be valued: the degree of knowledge of the basic principles of Optics, the precision in the arguments, the obtaining of exact numerical values, the appropriate use of units, the completeness of the solutions, the correct use of verbal, mathematical and / or language. or graphic. Serious conceptual errors will be penalized in the correction.

- Evaluation of laboratory practices through monitoring and reporting. Attendance to laboratory practices is mandatory. Students will deliver a complete report for each practice carried out, which will be assessed with a grade from 0 to 10. These reports will assess the application of knowledge to practical applications as well as the calculation of errors and their interpretation. The practice mark will be the average of the marks obtained in the practices carried out.

The final mark will be calculated according to the following percentages:
Practice mark (20%)
Final exam mark (80%)

To pass the course, it will be a necessary condition to have passed the practices, have a minimum mark of 5.0 in the final exam and have obtained an overall mark equal to or greater than 5.0.

In the case of continuous assessment, students may waive the call within a period that, at least, will be up to one month before the end of the teaching period for the subject. This resignation must be submitted in writing to the teaching staff responsible for the subject.

B) The students who want to be evaluated through the final evaluation system must present in writing to the coordinator responsible for the subject the waiver of continuous evaluation, for which they will have a period of 9 weeks, counting from the beginning of the semester, according to the academic calendar of the center. In this case, the learning results will be evaluated through a test, consisting of:

-A final exam that will include the resolution of exercises and the development of a theoretical topic:
The following will be valued: the degree of knowledge of the basic principles of Optics, the precision in the arguments, the obtaining of exact numerical values, the appropriate use of units, the completeness of the solutions, the correct use of verbal, mathematical and / or language. or graphic. Serious conceptual errors will be penalized in the correction.

- A practical exam that will be carried out in the laboratory and will last three hours. In this exam, they must make a report of a practice that must contain: obtaining and mathematical treatment and graphing of experimental data, calculation of errors, discussion of results and conclusions of the work.

The final mark will be calculated according to the following percentages:
Practice exam mark (20%)
Final exam mark (80%)

To pass the course, it will be a necessary condition to pass the practical exam and have obtained an overall mark equal to or greater than 5.0.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The following evaluation tools will be used:

- A final exam that will include the resolution of exercises and the development of a theoretical topic. The following will be valued: the degree of knowledge of the basic principles of Optics, the precision in the arguments, the obtaining of exact numerical values, the appropriate use of units, the completeness of the solutions, the correct use of verbal, mathematical and / or language. or graphic. Serious conceptual errors will be penalized in the correction.

- A practical exam to be carried out in the laboratory. Those students who have not passed the practices during the course must take a practice exam that will be carried out in the laboratory and will last three hours. In this exam, they must make a report of a practice that must contain: obtaining and mathematical treatment and graphing of experimental data, calculation of errors, discussion of results and conclusions of the work.

The final mark will be calculated according to the following percentages:
Practice exam mark (20%)
Final exam mark (80%)

To pass the course, it will be a necessary condition to have passed the practices, have a minimum mark of 5.0 in the final exam and have obtained an overall mark equal to or greater than 5.0.

MANDATORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

Optics, E. Hecht, Ed. Addison Wesley, 2001.
Light, R.W. Ditchburn, Ed. Dover, New York, 1991
Fundamentals of Optics, F.A. Jenkins and H.E. White, McGraw-Hill, 1981.

Detailed bibliography

Principles of Optics, M. Born and E. Wolf. 7th edition, Cambridge University Press, Cambridge, 1999.
Modern Optics, R. Guenther, Ed. Wiley & Sons, 1990

Journals

Journals:
Physics Education
The Physics Teacher
European Journal of Physics
American Journal of Physics

Web sites of interest

http://www.enciga.org/taylor/lv.htm
http://www-optics.unine.ch/education/optics_tutorials/optics_tutorials.html
http://www.ub.es/javaoptics/index-en.html
http://www.cordonline.net/laserapplets/

OBSERVATIONS

Universidad del País Vasco Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27352 - Industrial Automation & Communications **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The aim of the course is to provide an overview of the most common technologies used in automation and industrial process control, and hierarchical organization of the usual devices that the industry employs.

The course looks for a balance between theoretical, methodological, technological and practical subjects.
- Theoretical regarding basics on industrial automation and the required elements. It will build upon the subject of computers, acquired in the first course taught concerning the information coding and programming.
- Methodological regarding on the design of systems for automated production systems.
- Technological regarding on the study of instrumentation components, industrial communications and monitoring systems.
- Practical regarding on to laboratory sessions that will be held on programmable logic controllers (PLCs) and industrial communications networks, trying to solve real automation issues.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

This subject is within the optional module covering specific competence "Ability to design control systems and industrial automation" (M07OP3). It is developed within the degree specific competence "Knowledge of basic materials and technologies, enabling to learn new methods and technologies and that will provide versatility to adapt to new situations" (G003).

At the same time, it involves basic competences like:
- MEC1: Students have demonstrated knowledge and understanding in a field of study that starts of the basis of general secondary education, and is typically at a level which, although it is supported by advanced textbooks, includes some aspects that involve knowledge of the forefront of their field of study.
- MEC5: Students have developed those skills needed to undertake further studies with a high degree of autonomy.

Once the course is completed, students will know what methodology followed in the development of an automation project, they can choose the technologies and equipment suitable for such a solution, and know how to integrate all elements within industrial production systems.

Theoretical and Practical Contents

THEORETICAL SUBJECTS:

1st Lesson. Introduction to the Industrial Automation Systems.
2nd Lesson. Programmable Logic Controllers. Hardware and Software Architecture
3rd Lesson. Combinational Systems.
4th Lesson. Sequential Systems.
5th Lesson. Data Processing.
6th Lesson. Functions and Function Blocks.
7th Lesson. Introduction to the Industrial Communications.
8th Lesson. Industrial communications Device Oriented.
9th Lesson. Industrial communications Control Oriented.

TEORICAL SUBJECTS DEVELOPMENT:

1st BLOCK - INDUSTRIAL AUTOMATION

1st Lesson. Introduction to the Industrial Automation Systems
Blocks of an automation system. Targets in the automation. Industrial automation system components. Control system functions. Automation technologies. Industry automation systems: history, development, programming languages, applications.

2nd Lesson. Programmable Logic Controllers Architecture
Functional blocks. PLC operations. PLC hardware components. Processing. PLC families. Addressing. Inputs and outputs.

3rd Lesson. Logic Controllers Programming
3.1 Lesson. Introduction to the IEC61131 Standard: parts of the standard, programming languages, program design.

3.2 Lesson. Programming Basics - STEP7: Program structure, Module types, Processing types, Cycle and response times.

2nd BLOCK - INDUSTRIAL SYSTEMS INTEGRATION

4th Lesson. Industrial Communications
Historical vision, communications in manufacturing environments, technologies, manufacturer architectures, basic protocols for industrial communications, field buses.

5th Lesson. PROFIBUS
Definition and standards, general features, technical features, PROFIBUS architecture, physical level - PHY (topology, transmission method), link level - FDL (transmission protocol, token passing, times, FDL services) FMA1/2 services.

6th Lesson. Industrial Ethernet
Industrial Ethernet solutions, Ethernet communications, technical features.

7th Lesson. PROFINET
Fundamentals, transmission systems in real time, decentralized field devices, decentralized automation.

8th Lesson. OPC
Purpose, location, architecture, databases, OPC, objects and interfaces, OPC applications, general architecture and components, local and remote servers, OPC standards.

SEMINAR SUBJECTS:DEVELOPMENT:

- 1st Seminar: Description of the industrial automation systems
- 2nd Seminar: Building blocks
- 3rd Seminar: SFC design (GRAFCET)
- 4th Seminar: Process data access communications
- 5th Seminar: Control communications
- 6th Seminar: High level communications
- 7td Seminar: Final Project

PRACTICAL SUBJECTS:DEVELOPMENT:

- 1st Practice: Development environment
- 2nd Practice: Combinational Systems
- 3rd Practice: Sequential Systems 1/2
- 4th Practice: Decentralized peripherals communications
- 5th Practice: Control communications
- 6th Practice: High level communications
- 7th Practice: Final Project

TEACHING METHODS

In this course several methodologies are used, depending on the type of education:
- Master Lecture: Offering brief presentations of theoretical content will be taught by the teacher, carrying out various individual activities by the student.
- Seminary Mode: Brief theoretical/practical exhibitions will be taught by the teacher, devoting part of the on-site time to the realization of individual and group activities.
- Laboratory Model: Different works about case of concept in which implement the contents in lectures and seminar in order to strengthen both autonomous and group work .

A final group work will be is performed for the resolution of a case study that will bring together the different methodologies and technologies developed in the different modes.

TYPES OF TEACHING

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

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Multiple choice test 30%
- Exercises, cases or problem sets 10%
- Individual assignments 30%
- Teamwork assignments (problem solving, Project design) 30%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Written Test: 30% (Pass score 40%)
Seminar/Laboratory: 70% (Continuous Assessment)
Disposition for Seminar Sessions: 10% (Independent work - Pass score 50%)
Laboratory Practices: 30% (Independent work - Pass score 50%)
Final work: 30% (Group work - Pass score 50%)

The renounce to the ordinary call or to the continuous assessment will be notified personally and in the format agreed at the start of the course, to the coordinator or teacher of the course, 2 weeks before the end of the quarter in which the subject is taught.

In case of renounce to the continuous assessment, a seminar/laboratory test will be made.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Written Test: 30% (Pass score 50%)
Laboratory Test: 70% (Pass score 50%)

The renounce to the extraordinary call will be notified personally and in the format agreed at the start of the course, to the coordinator or teacher of the course, 2 weeks before the date of the resist exam of the subject.

MANDATORY MATERIALS

Students will be equipped with the informatics (software) needed for the development of the different works:
- Tools for hardware devices configuration
- Programming tools for the devices
- Programming tools for communications

BIBLIOGRAPHY

Basic bibliography

Title: Automating with SIMATIC S7-1500: Configuring, Programming and Testing with STEP 7 Professional (2nd Edition)
Authors: Hans Berger
Publisher: Wiley
Year of Publication: 2017

Title: IEC 61131-3: Programming Industrial Automation Systems (2nd edition)
Authors: Karl Heinz John, Michael Tiegelkamp
Publisher: Springer
Year of Publication: 2010

Title: Industrial Communication Systems (2nd Edition)
Authors: Bogdan M. Wilamowski, J. David Irwin
Publisher: CRC Press
Year of Publication: 2018

Title: Profibus. The Fieldbus for Industrial Automation
Authors: K. Bender. Carl Hanser Verlag
Publisher: Prentice
Year of Publication: 1993

Title: Industrial communication with PROFINET
Authors: Manfred Popp
Publisher: Profibus-Profinet International
Year of Publication: 2015

Title: OPC - From Data Access to Unified Architecture
Authors: J. Lange, F. Iwanitz, T.J. Burke
Publisher: Vde Verlag Gmbh, 4ªEdición
Year of Publication: 2010

Detailed bibliography

Title: Programming Siemens Step 7 (TIA Portal), a Practical and Understandable Approach (2nd Edition)
Authors: Jon Stenerson, David Deeg
Publisher: Independiente
Year of Publication: 2019

Title: Programación de controladores avanzados SIMATIC S7 1500 con TIA Portal, AWL/KOP y SCL (3ª Edición)
Authors: Luis Peciña Belmonte
Publisher: Marcombo
Year of Publication: 2019

Title: Automating with PROFINET: Industrial Communication Based on Industrial Ethernet
Authors: Raimond Pigan, Mark Metter
Publisher: Wiley
Year of Publication: 2008

Title: Programming Industrial Control Systems Using IEC 1131-3 (2nd Revised edition)
Authors: Robert W. Lewis
Publisher: Institution of Engineering and Technology
Year of Publication: 1998

Title: Industrial Communication Technology Handbook (2nd Edition)
Authors: Richard Zurawski
Publisher: CRC Press
Year of Publication: 2017

Title: Comunicaciones Industriales y WinCC
Authors: Luis Peciña Belmonte
Publisher: Marcombo
Year of Publication: 2018

Title: Decentralization with Profibus-DP. Architecture and Fundamentals
Authors: J. Weigmann, G. Kilian
Publisher: Siemens
Year of Publication: 2000

Title: Comunicaciones Industriales y WinCC
Authors: Luis Peciña Belmonte
Publisher: Marcombo
Year of Publication: 2018

Title: Industry 4.0, The Industrial Internet of Things
Authors: Alasdair Gilchrist
Publisher: Apress Berkeley, CA
Year of Publication: 2016

Journals

Automática e Instrumentación http://www.tecnipublicaciones.com/automatica/
Control Engineering Practice. A Journal of IFAC, the International Federation of Automatic Control. http://www.elsevier.com/

Web sites of interest

IFAC-International Federation of Automatic Control. http://www.ifac-control.org/
Comité Español de Automática. http://www.cea-ifac.es/
PI - PROFIBUS & PROFINET International http://www.profibus.com/
OPC Foundation http://www.opcfoundation.org/

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27362 - Deployment & Management of Networks & Services **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The course aims at applying the network architecture and interconnection principles in the telematics modules so that students develop the skills to deploy a whole end-to-end system including all nodes and services required.
They will therefore design and configure in a lab environment the addressing/routing mechanisms and internetworking protocols from link layer and up to the application layer to support the information exchange among all the elements in the telecommunication service supply chain (that would include both describing, programming and validating routing and signalling elements throughout the architecture).
On the other hand the infrastructure designed should be able to deliver required QoS levels and guarantee proper performance of deployed services. To that end, optimization mechanisms and enhancements will be also considered in order to face possible service degradation situations.
In the scope of the telematics module this course aims at combining the views from "Access Networks" and "Transport Networks" courses in a holistic e2e manner.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The course aims at applying the network architecture and interconnection principles in the telematics modules in order the students to be able to deploy a whole end-to-end system including all nodes and services required.
* Design and configure in a lab environment the addressing/routing mechanisms and internetworking protocols from link up to application layer to support the information exchange among all the elements in the telecommunication service supply chain (Competence TE2 -routing, signaling- and TE4 -description and validation of protocols and interfaces- from the Telematics Module)
* Design a infrastructure as to deliver required QoS levels and guarantee proper performance of deployed services (TE5 -enhancements of networks and services via technological- and TE6 -designg of architecture-)
* Empiricallly evaluate the obtained performance and propose posible enhancements/optimization mechanisms to face degradation conditions (TE3 -ability to compose services by using planning and analysis tools-).

Theoretical and Practical Contents

It is basically a lab course so most lab tasks are to be accomplished by student teams/groups following this structure::
1. Introduction to the simulated company networking and services requirements/problems.
2. HW and SW installation and maintenance.
3. Basic services and link level.
4. Isolated company network.
5. Interconnection.
6. Network management and modeling.
7. Advanced services and enhancement.

TEACHING METHODS

Students, organized into small groups, will have to face the design and deployment of the communications infrastructure (networking and services, as well as interconnection with other companies) of a fictitious company. This design should cover not only exclusively technical aspects, but also consider cost rationality and suitability for each company's casuistry. It is, therefore, a methodology close to PBL (project-based learning), in which each group will establish, under the supervision of the teaching staff, the most appropriate projects for each company, and establish the limits of the development to be carried out.
As a prerequisite, it will be necessary to polish basic competences of administration of networks and servers on an individual basis, which will be useful in the subsequent deployment of the group models. In any case, trying to mimic a professional environment, students’ autonomous work will be encouraged, by means of the consultation of forums, manuals, tutorials and diverse computer resources, limiting the magisterial part of the course to a brief exposition of the problematic that is pursued to approach in each case.
In order to ensure feedback, there will be a follow-up of the activities, such as the definition of the "fictitious company" to be deployed, as well as two public presentations (an intermediate one, with a more academic focus and a final pitch aimed to business angels or prospective investors).

TYPES OF TEACHING

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

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Oral defence 23%
- Teamwork assignments (problem solving, Project design) 69%
- Oral presentation of assigned tasks, Reading¿ 8%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

This is a 100% lab course, Project based.
Therefore, the initial server admin task will be individually evaluated but all the rest will be presented as group tasks (including task reports, public defenses, etc..)
Final mark will be the weighted sum of the partial ones following the distribution in this guide.
The students are entitled to dismiss the continuous evaluation and apply for a single final probe by carrying out the procedures (and according to the deadlines) in the official UPV/EHU BSC student rules.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Considering that all the practical skills must be evaluated the student will present his working company project in an oral defence and show it actually working according to the specification.

MANDATORY MATERIALS

Provided it is a project based course students' capability to face on their own the problems is particularly encouraged. Therefore, at the beginning of each lab some initial guidance will be provided but the groups will later search for information online.

BIBLIOGRAPHY

Basic bibliography

Basic bibliography is associated with every single tool/software to be used for the deployment of the simulated company's network. In fact, the course itself demands students to be responsible for the research phases either via online browsing of by using manufacturers' handbooks/tutorials (even those available in previous courses).

Detailed bibliography

LIFS (various authors, available online www.tldp.org)
The Linux System Administrator's Guide (various authors available online www.tldp.org)
Linux Advanced Routing & Traffic Control (various authors, available online http://www.lartc.org/)

Journals

Being a mostly practical engineering lab no research journal is foreseen as useful.

Web sites of interest

Manuals
http://www.tldp.org/
http://www.lartc.org
http://www.cisco.com
Software
https://sourceforge.net/
https://github.com/
https://www.kernel.org
stackoverflow.com/
News
www.reddit.com
www.slashdot.org
www.barrapunto.com

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27364 - Laboratory of Communications Electronics **Credits, ECTS:** 4,5

COURSE DESCRIPTION

This subject is the framework where the knowledge acquired in electronics in the previous courses is developed through practical implementations. It complements the subject of Circuits of Telecommunication of the same specialty. It focuses, but not exclusively, on those circuits, systems and measurement instruments used in communications electronics systems and circuits.

Subjects require to acquire module competences:

COURSE 1st: Basic Electronics, Devices and Electronic Circuits
COURSE 2: Theory of Communication. Electromagnetic fields.
COURSE 3º: Circuit Electronics, Telecommunication Systems, Radiocommunication Systems. High Frequency Systems. Electronic Instrumentation. Electronic power systems.
COURSE 4: Telecommunication Circuits, Electronic Systems Technology.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Goals:
- Analyze and deepen the operation of electronic systems for the transmission of signals generated by telecommunication systems.
- Assess, determine and specify the reliability and accuracy of electronic telecommunication systems.
- Design and solve electronic systems of telecommunication systems through individual and cooperative work.
- Detect, assess and solve problems affecting telecommunications systems due to different types of sources of disturbance.

Competencies:

Professional or specific
- Identification and resolution of communication engineering problems using electronic systems.
- Design capability oriented to the electronic product.

Transversal or general
- General reasoning, applied and critical.
- Autonomous Learning.
- Search for information.

Specific competences of the MO5 module - Electronic Systems:
-M05SE1: Ability to build, exploit and manage systems of capture, transport, representation, processing, storage, management and presentation of multimedia information, from the point of view of electronic systems.
-M05SE3: Ability to perform the specification, implementation, documentation and set-up of equipment and systems, electronic, instrumentation and control, considering both the technical aspects and the corresponding regulatory regulations.
-M05SE5: Ability to design circuits of analog and digital electronics, analog-digital and digital-analog conversion, radiofrequency, power and electric power conversion for telecommunication and computer applications.
-M05SE6: Ability to understand and use feedback theory and electronic control systems.
-M05S58: Ability to specify and use electronic instrumentation and measurement systems.
-M05S59: Ability to analyze and solve problems of interference and electromagnetic compatibility.

Theoretical and Practical Contents

Design and assembly of basic electronic subsystems in telecommunications systems
- Electronic components and selection criteria
- Oscillators
- Modulators and Demodulators
- Small Signal Amplifiers
- Power Stages

Instrumentation and measurement techniques
- Synthesized signal and function generator
- Spectrum analyzer
- Network Analyzer

- Vector Modulator Analyzer

TEACHING METHODS

Methodology of teaching based on laboratory work, which consists of designing and constructing, through a series of guided practices, electronic subsystems for the implementation of basic functions in telecommunications.
The student must design, assemble, measure, improve the designs until they meet the required starting specifications, and finally characterize the built circuits.
The subject will be managed through a virtual platform that will allow the immediate sharing of messages and information, access to documentation and electronic specification sheets, consultations, discussion groups, etc.
The non-presence part will be dedicated to the search of information, reading of documentation, specification sheets and application notes, and the preparation of designs and even electronic assembly of prototypes, as well as electronic simulation of subsystems which may be relevant. It will also be dedicated to the completion of the final reports of the practices carried out.
To prepare the laboratory practices there will be brief lectures and a previous job of searching information on the web. In laboratory practices, the proposed electronic systems should be designed, simulated and physically realized. Finally, the electronic system should be characterized with a report.
In the event that the sanitary conditions prevent the realization of a teaching activity and / or face-to-face evaluation, a on-line modality will be activated of which the students will be informed promptly.

TYPES OF TEACHING

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

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Oral defence 20%
- Exercises, cases or problem sets 40%
- Teamwork assignments (problem solving, Project design) 40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The scores will be based on the evaluation of the work performed in class, the prototypes to be designed and assembled, and the final report of the prototype assemble and, which should include the design process and the characterization of the implemented circuits.
Evaluation instruments:
- Attendance control sheet through ICTs and presence.
- Written report of the theoretical realization by means of simulation of the proposed practices.
- Resolution in the laboratory of the proposed practices.
- Written report of laboratory practices.

The resignation procedure is the one included in the corresponding regulations. The evaluation of those students that accept the resignation is done by a test for the 100% of the subject.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation in second call consists of a test, for the 100% of the subject, to be carried out in the laboratory.

MANDATORY MATERIALS

Orcad, PSpice, LTspice, Agilent ADS or equivalent CAD/CAE tool.

BIBLIOGRAPHY

Basic bibliography

Peter Wizmuller, RF Design Guide: Systems, Circuits and Equations, Artech House, Inc, 1995
H. L. Krauss, C. W. Bostian, F. H. Raab. Solid State radio Engineering. John Wiley & Sons 1980
Clarke-Hess. Communication Circuits: Analysis an Design. Addison Wesley 1978
Steve C. Cripps. RF Power Amplifiers for wireless Communications. Artech House 1999
RF Circuit Design, Christopher Bowick, 2nd Edition, Newnes-Elsevier 2008

Detailed bibliography

Pieter L.D. Abrie. Design of RF and Microwave Ampliers and Oscilators. Artech House, Inc. 1999
RF Power Transistor Manual. RCA Corporation 1971.
Sven-Olof Öhvrick, Radio School. Transmitter Technology RT1C. Ericcson Radio System AB 2000.
David M. Pozar. Microwave Engineering. Addison-Wesley
Chris Bowick. RF Circuit Design. SAMS
Irving M Gottlieb. Practical RF Power Design Techniques. TAB books McGraw-Hill 1993
Inder Bahl, Prakash Bhartia, Microwave Solid State Circuit Design, John Wiley & Sons, Inc. 1988

Journals

RF Design
Microwaves & RF
Microwave Engineering
Microwave Journal

Web sites of interest

http://www.radioelectronicschool.net/
http://www.mwjournal.com
http://www.mwee.com/
http://www.mwrf.com/
http://rfdesign.com/

OBSERVATIONS

The subject has a MOODLE server (eGela).

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27373 - Optic Communications **Credits, ECTS:** 4,5

COURSE DESCRIPTION

Optical communications is an elective subject given on the first four-month period of the 4th year in the Faculty of Engineering in Bilbao, and it is linked to the module Telecommunication Systems.

The subject is devoted to the fiber-optic communications employed in information technology. Optical communications are taking on a more important role in the field of telecommunications engineering. Therefore, this is a key subject to learn, analyze, evaluate and design the elements, devices, systems and networks that make use of such a technology.

The subject will not be difficult to follow provided that the student is able to solve problems with skill in calculus and statistics (subjects 'Calculus I', 'Algebra' and 'Statistics' of the 1st year). Likewise, it is required a working knowledge both in solving problems related to the propagation of electromagnetic fields (subject 'Electromagnetic Fields' of the 2nd year) and in handling circuits, components and subsystems used with high frequency signals (subject 'High frequency systems' of the 3rd year).

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Competencies are the correct combination of knowledge, skills and abilities, attitude and values; all of them are necessary to perform correctly a job. The specific competencies are acquired and developed in the module Telecommunication Systems, whereas the general and transversal competencies are developed during the whole degree of Telecommunications Engineering (Grado en Ingeniería en Tecnología de Telecomunicación).

Students of this subject will acquire the following competencies:

Specific competencies:
- Ability to select circuits, subsystems and systems for radio-frequency, microwave, broadcasting, radio link and radiodetermination (M03S4).
- Ability to select antennas, pieces of equipment and systems for transmission and guided and non-guided wave propagation by electromagnetic, radio-frequency related or optical means, as well as to manage the corresponding radio spectrum and frequency assignment (M03S5).

General and transversal competencies:
- Knowledge of the fundamental topics and technologies that allow students both to learn new methods and technologies and to adapt themselves to any new situation (G003).
- Ability to solve problems with initiative, decision making, creativity, and to communicate and transfer knowledge, skills and abilities, understanding the ethical and professional responsibility in the performance of the Technical Telecommunications Engineering (G004).

Theoretical and Practical Contents

The subject is divided into two sections:
- On one hand, in the lectures + practical classroom work + seminars, contents are worked both individually by students and in groups of three or four, and they consist of 5 lessons.
- On the other, in the practical laboratory work, students work in groups of three or four, and they have to complete 8 practical tasks. Previously, one training lesson is given so that students carry out successfully their tasks.

Lectures + practical classroom work + seminars:
- Lesson 1: Introduction to optical fibers.
Critical angle and evanescent field. Optical fiber: structure, types, applications, refractive index profiles, numerical aperture and transmission capacity. Historical view.
- Lesson 2: Propagation in optical fibers.
Attenuation: intrinsic and extrinsic mechanisms, transmission windows and maximum distance limited by attenuation. Dispersion: concept and effects, types of dispersion and maximum distance limited by dispersion. Cables and fibers: structure and types of cables. Connectors and splices: intrinsic and extrinsic losses, connector and splice losses.
- Lesson 3: Optical emitters.
LEDs: working principle, SLEDs, ELEDs and efficiencies. Lasers: working principle, Fabry-Perot laser, efficiencies, emission modes and lasers based on distributed mirrors. External modulators.
- Lesson 4: Optical detectors and network design.
Photodiodes: working principle, efficiencies and responsivity, spectral features and avalanche photodiodes vs PIN photodiodes. Design of an optical link taking into account the times of response of the laser, of the optical fiber and of the receiver.

- Lesson 5: Optical amplifiers and non-linear effects.
Optical amplifiers: working principle, EDFA, SOA and Raman. Non-linear effects: classification and description.

Practical laboratory work:
- Training lesson for practical laboratory work: Introduction and safety. Metrology. Study of uncertainties.
- Practical task 1: Measurement of passive devices in monomode fibers.
Measurement of bending losses. Couplers.
- Practical task 2: Measurement of the numerical aperture and other parameters of interest in multimode fibers.
Misalignment losses in fibers. Attenuation in optical fibers with connectors using different LEDs.
- Practical task 3: Measurement of active devices and WDM transmission systems.
Measurement of a semiconductor laser. Power-current curve. Transmission with wavelength division multiplexing.
Measurement of the attenuation in demux filters.
- Practical task 4: Measurement of monomode fiber communications links.
Learning to use an optical time-domain reflectometer (OTDR). Measurement of the attenuation and insertion losses in fiber links.
- Practical task 5: Investigation of the dispersion and the attenuation in multimode fiber optical links.
Measurement of the dispersion and the attenuation as a function of the link length.
- Practical task 6: Investigation of the eye diagram and the bit error rate in multimode fiber optical links.
Investigation of the quality factor and bit error rate as a function of the link length.
- Practical task 7: Simulation of digital transmission systems.
Simulation of digital transmission systems in medium-range distances using monomode fibers.
- Practical task 8: Design and optimization of a digital transmission optical network.
Design and optimization of a digital transmission optical network using monomode fibers.

TEACHING METHODS

Students of this subject work individually or in groups. The methodology is explained in more detail below:

- Cooperative masterclasses (lectures):
The theoretical basics and concepts are explained by the lecturer. In order to encourage students to participate, theoretical lectures are alternated with mathematical tasks performed in groups of three or four students. Furthermore, the lecturer assists students with the study and the reading of recommended bibliography in the hours of student work outside the classroom.

- Problem-solving activities (practical classroom work):
Problem-solving activities are carried out by the lecturer on the blackboard; these problems are related to the theory explained in the lectures (they are marked with an asterisk). Students are also encouraged to participate and discuss in class, involving question-answer type interactions, as well as problem-solving activities of a certain subsection on the blackboard by one student chosen by drawing. In such an interaction, mistakes in problem-solving activities can be as valuable as correct answers, since they make it possible to identify items that were not clear enough and correct common mistakes.

- Problem-solving task-based learning (seminars):
Students solve the remaining problems (i.e. not marked with an asterisk) in groups of three or four. Students are encouraged to prepare them beforehand (in the hours of student work outside the classroom). In addition, upon completion of each lesson, a group must give a brief presentation (of aproximately 15 minutes) about more specific aspects related to that lesson by using the material provided by the teacher. Such activities will allow the teacher to track the learning results of students.

- Practical task-based learning (practical laboratory work):
Students perform experimental measurements and simulations in groups of three or four (there are 8 practical tasks). Previously, students can read the manuals thoroughly and prepare each practical task in the hours of student work outside the classroom. Afterwards, in the practical laboratory work, each group performs the experimental measurements or the simulations, and the results are recorded, processed and documented in a report. The lecturer assists each group both with their measuring and with the development of the report in order to improve successive practical tasks and reports. Assistance from lecturer takes place in the hours of face-to-face teaching of the subject, as well as in office hours.

Note: should the health conditions prevent any face-to-face teaching and/or assessment, such activity will move online, and students will be kept informed in a timely manner.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	7,5	15	7,5	15					
Horas de Actividad No Presencial del Alumno/a	11,25	22,5	11,25	22,5					

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 20%
- Multiple choice test 8%
- Exercises, cases or problem sets 7%
- Teamwork assignments (problem solving, Project design) 60%
- Oral presentation of assigned tasks, Reading¿ 5%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

To pass the subject it is required to get at least a 50% pass mark on:
- the lectures + practical classroom work + seminars
and on
- the practical laboratory work.

Assessment of the lectures + practical classroom work + seminars:
- For continuous assessment:
  * Two questionnaires in the eGela virtual platform (8% of the total grade).
  * A series of problems (7% of the total grade).
  * A brief presentation (5% of the total grade).
  * A written exam in the official examination date of the final assessment test (20% of the total grade).
- For final assessment (for students that requested to be graded by final assessment):
  * A questionnaire and a written exam in the official examination date of the final assessment test (40% of the total grade).

Assessment of the practical laboratory work:
- For continuous assessment:
  * Eight reports of the experimental measurements and simulations processed correctly (60% of the total grade).
- For final assessment (for students that requested to be graded by final assessment):
  * A practical exam after the written exam in the official examination date of the final assessment test (60% of the total grade).

Withdrawal from continuous assessment:
- Students have the right to be graded by final assessment: they must present a written request to do this, within 9 weeks, starting from the beginning of the four-month period.

Withdrawal from a call:
- For continuous assessment: students may withdraw from the ordinary exam call one month before the end of the teaching period. To do this, they must present a written request to this end. Otherwise, non-attendance at the exam call in the official examination date of the final assessment test will result in a failing grade (NOT PASS will be applied).
- For final assessment (for students that requested to be graded by final assessment): non-attendance at the exam call in the official examination date of the final assessment test will result in a withdrawal (NOT PRESENTED will be applied).

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

To pass the subject it is required to get at least a 50% pass mark on:
- the lectures + practical classroom work + seminars
and on
- the practical laboratory work.

Assessment of the lectures + practical classroom work + seminars and the practical laboratory work:
- A questionnaire and a written exam (40% of the total grade) + a practical exam (60% of the total grade) in the official examination date of the final assessment test.

Students who achieved at least a 50% pass mark in the assessment of the lectures + practical classroom work + seminars

or in the assessment of the practical laboratory work of a previous call: it is possible to keep the mark of the corresponding assessment.

Withdrawal from a call:
- Non-attendance at the exam call in the official examination date of the final assessment test will result in a withdrawal (NOT PRESENTED will be applied).

MANDATORY MATERIALS

Lecture materials and notes are available in the eGela virtual platform:
- PowerPoint slides used in the lectures.
- Questions from the exercises worked on in the practical classroom work and in the seminars.
- Manuals and reports of the practical laboratory work.

Information about the use of materials, media and resources:
- During teaching activities (continuous assessment):
  * Students are permitted to use books or course notes as well as electronic or computer systems or devices. Should these systems or devices have access to the Internet, any search for other than instructional materials will be prohibited. In any case, no telephone systems, devices or any other type of help are permitted.
- In the final assessment test (both continuous assessment and final assessment):
  * Students are only permitted to use calculators. Neither books or course notes nor telephone, electronic or computer systems or devices nor any other type of help are permitted.

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Revista Española de Metrología: www.e-medida.es

Web sites of interest

RP photonics encyclopedia: www.rp-photonics.com/encyclopedia.html
EXFO glossary: www.exfo.com/support/services/instrument-services/be-expert-training-program/animated-optical-glossary
International Telecommunication Union (G Series Recommendations): www.itu.int/ITU-T/recommendations/index.aspx?ser=G
Bureau International des Poids et Measures: www.bipm.org
Centro Español de Metrología: www.cem.es
Asociación Española de Normalización y Certificación (AENOR): www.aenor.es

Entidad Nacional de Acreditación: www.enac.es

OBSERVATIONS

- Students will be subjected to the 'Academic ethics policy and prevention of dishonest and fraudulent activities of the University of the Basque Country (UPV/EHU)'.
- Attendance of the lectures + practical classroom work + seminars is optional. Nevertheless, students who do not attend and do not show any doctor's note will have to get up to date with the lecture material.
- Attendance of the practical laboratory is compulsory for students accepting the conditions of continuous assessment of this type of teaching. Students who do not attend and do not show any doctor's note will receive no marks in the corresponding report.

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27377 - Mobile Networks and Services **Credits, ECTS:** 4,5

COURSE DESCRIPTION

In this course the particularities of the wireless mobile environment regarding the provision of telecommunications services are identified and the necessary adjustments at different levels compared to the non-mobile environment are analysed. Different technological solutions to provide mobility are studied and compared, analysing the specific problems solved by each of them, their application environment, network architecture, protocols, types of services they can offer...
The course seeks a specialization in the telematics aspects of mobile networks and services, fostering the acquisition of the skills to apply the techniques required by both telephony and data networks to the ever-growing mobile environments.
The course is based on the general networking concepts presented in the course "Architecture of Telecommunication Networks and Services" which are particularized in this course for mobile networks. In addition, "Mobile Networks and Services" forms a block with two other courses: "Access Networks" and "Transport Networks". In the first one, the different technologies that allow the users to access the data networks are covered. Wireless and mobile networks are a subset of these technologies that in "Mobile Networks and Services" is studied in depth. In the second backhaul and interconnection networks are analysed.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

BASIC COMPETENCIES
. Students have demonstrated knowledge and understanding in a field of study that has its foundations on the general secondary education, and it is typically at a level which, although it is based on advanced textbooks, includes some aspects that involve knowledge of the forefront of their field of study.
. Students can apply their knowledge to their work or vocation in a professional manner and have skills typically demonstrated through devising and defending arguments and solving problems within their field of study.
. Students have the ability to gather and analyse relevant data (usually within their field of study) to make judgments that include reflection on relevant social, scientific or ethical aspects.
. Students can communicate information, ideas, problems and solutions to both specialised and non-specialised audiences.
. Students have developed those skills needed to undertake further studies with a high degree of autonomy.

COMPETENCIES OF THE GRADE
. Knowledge of basic subjects and technologies that enable the student to learn new methods and technologies and that will give him or her the versatility to adapt to new situations.
. Ability to solve problems with initiative, decision making, creativity, and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the activity of a Technical Telecommunications Engineer.
. Ability to work in a multidisciplinary group and in a multilingual environment and communicate, both in writing and orally, knowledge, procedures, results and ideas related to telecommunications and electronics.

SPECIALTY COMPETENCIES OF THE TELEMATICS MODULE
. Ability to apply the fundamental techniques of the networks, services and data communication applications, such as management systems, signaling and switching, routing, security (cryptographic protocols, tunneling, firewall, tarification mechanisms, authentication and contents protection), traffic engineering (graph theory, queuing theory and teletraffic) pricing and reliability and quality of service, either in fixed, mobile, personal, local or long distance environments with different bandwidths, including telephony and data.

LEARNING RESULTS.
. The students will be able to describe the problems and the particular needs that arise in the provision of telecommunication services due to the wireless mobile environment, and will also be able to analyse comprehensively and compare alternative solutions to address these problems.
. The students will be able to search and analyse information on a mobile technology, working in a team. They will be able to analyse and understand in depth and, in most cases, experimentally test this technology as a prerequisite to achieve the following learning outcomes.
. The students will be able to prepare an oral presentation on the technology that has been analysed, present it to the class and satisfactorily answer questions about it.
. The students will be able to discuss the characteristics, advantages and disadvantages of mobile technologies, and compare them reasonably.

Theoretical and Practical Contents

1. Mobile networks and services: Introduction and context.

2. Technological requirements of the mobile environment.
3. Mobile network technologies.

TEACHING METHODS

Regarding the teaching methodology, the course is divided into two parts. In the first 6 weeks of the course lectures are used to present the first two units. In the second part of the course (9 weeks) the class is organised in work groups to analyse different mobile technologies and present them to the class. Seminar classes and classroom practices are used in this stage to accomplish these tasks.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	17,5	15	12,5						
Horas de Actividad No Presencial del Alumno/a	26,25	22,5	18,75						

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 60%
- Teamwork assignments (problem solving, Project design) 30%
- Oral presentation of assigned tasks, Reading¿ 10%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the ordinary exam call, the mark will be the sum of 3 parts:
A. Partial examination: 10% of the mark
B. Analysis of technologies: 40% of the mark
C. Final examination: 50% of the mark

In order to pass the course, the students must meet the following conditions (all of them):
- Have participated actively in one of the working groups on technology.
- In the weighted sum (A + B * 0.1 * 0.4 * 0.5 + C), get at least 5 points (out of 10).
- In the weighted sum (A + C * 0.1 * 0.5), obtain at least 4 points (out of 10).

To decline to sit in the ordinary call of the course will be enough not to attend the final written test of the ordinary call.

If a student wants to decline the ongoing assessment, he/she must proceed according to the procedure and deadlines established in the Article 8.3 of the Student Assessment Rules of the UPV/EHU.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary exam call, the qualification will be determined by a final written test that will comprise the 100% of the subject.

To decline to sit in this call it will be enough not to attend the final written examination.

MANDATORY MATERIALS

Documentation available in the virtual classroom of the course in eGela.

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http://www.bluetooth.com/Pages/Bluetooth-Home.aspx
http://www.coit.es/foro/?op=cronologia&idcategoria=317 (Cronología de España)

OBSERVATIONS

En el caso de que las condiciones sanitarias impidan la realización de una actividad docente y/o evaluación presencial, se activará una modalidad no presencial de la que los/las estudiantes serán informados puntualmente

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27383 - Laboratory of Digital Systems **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The subject Digital Systems Laboratory is a compulsory subject of the Electronic Systems specialty in the fourth year of the Degree in Engineering in Telecommunication Technology.

The objective of this subject is to equip students with the ability to design and develop digital systems with hardware and software processing units integrated in an FPGA. These tailor-made mixed circuits offer a high degree of flexibility and high throughput. The incorporation of this type of devices in the products of the companies of the industrial sector is very interesting and the demand of professionals with capacity to work with this type of technologies is high.

In this subject, from a practical approach, students deal with high speed hardware design oriented to reconfigurable devices, the detailed study of a simple soft processor embedded in the reconfigurable device and the design methodology necessary to face the complete development of a mixed system.

The subjects Digital Electronics and Digital Systems converge in this subject. The concepts and capacities acquired in them must be applied intensively, extensively and in combination. In this way, the bases are established to be able to face the design of complex systems based on platforms.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

In this subject the competences M05SE4 and M05SE5 of the module M05 Electronic Systems are worked:
M05SE4: Ability to apply electronics as support technology in other fields and activities, and not only in the field of Information Technology and Communications.
M05SE5: Ability to design circuits of analog and digital electronics, analog-digital and digital-analog conversion, radiofrequency, power and electric power conversion for telecommunication and computer applications.

The following are the most important learning outcomes that students should acquire through this subject:
- Identify the internal architecture of the FPGAS.
- Properly describe the fundamental circuits for the synchronous digital design at high speed.
- To know the process of synthesis and implementation of complex designs based on FPGAs.
- Describe mixed circuits composed of a small processor to which custom circuits are added and the program that runs on it.
- Perform the co-simulation of mixed circuits and the test using embedded logic analysis.
- Document complex designs realized in FPGAs using a specification document and a reference design.

Theoretical and Practical Contents

Topic 1: Advanced electronic design with FPGAS
VHDL design optimized for FPGA architecture
Synchronous design
Advanced management techniques of global clocks
Management of design constraints

Topic 2: Design with soft mini-processors
Mixed-core architecture
8-bit soft microprocessor
Code generation

Topic 3: Hardware-software integration in an FPGA
Integration of software in FPGA design flow
Cosimulation

TEACHING METHODS

The subject is taught in a clearly practical orientation.

In the laboratory students work individually and also in groups. Several projects are developed, some highly guided and others with a free part for students to use their imagination and autonomous work. It stimulates the planning and organization of work, study inside and outside the classroom, positive attitude towards peers, oral and written expression, discussion of answers, bibliographic search and use of English.

The master classes explain the fundamental concepts. The students must deepen these concepts through the study of theoretical contents and the realization of practical exercises.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	7,5			12,5	25				
Horas de Actividad No Presencial del Alumno/a	11,25			18,75	37,5				

Legend:

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Multiple choice test 10%
- Individual assignments 15%
- Teamwork assignments (problem solving, Project design) 75%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the subject is done through the continuous assessment system.
The weight of the different activities in the final note is as follows:

Test (10%)

Individual basic practices (15%)

Final practice in team (75%)

The relinquishment must be requested as indicated by current regulations.

The student who does not carry out the continuous evaluation or who, having renounced it, does not attend the final ordinary call, will have a grade of Not Presented.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation in the extraordinary call will be carried out based on an written exam about the topics of the subject.

MANDATORY MATERIALS

Documents in the egela platform of this subject.

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Web sites of interest

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OBSERVATIONS

Universidad del País Vasco Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27386 - Antennae & Propagation **Credits, ECTS:** 4,5

COURSE DESCRIPTION

To adequately perform the functions related to radio applications inherent to telecommunications, it is necessary to master the operation and design of antennas and radiant systems, and the propagation of radioelectric waves.

The subject comparatively studies, on the one hand, the physical and technological foundations of the different types of antennas or radiating systems, and on the other, the radioelectric propagation algorithms, used in the professional deployment of the increasingly numerous information technology services that are based on wireless communications, such as mobile phone services, broadcasting, radar, radiolocation, etc.

In the part of radiant systems, three steps are followed. First of all, starting from the physical foundations of electromagnetic radiation, the operation of some elementary antennas is analytically characterized. From this analysis, the key parameters for the characterization of radiant systems are obtained, which allow the design or the comparative evaluation of different options of radiant systems for their optimal integration in a radiocommunication system. Last, the most complex radiant systems and antenna arrays are analyzed with the support of practical work carried out using simulation software packages.

In the radio propagation part, a similar progressive approach is followed: starting from the review of the characteristic phenomena of the propagation of electromagnetic waves at different frequencies, the effects that these phenomena may have on a radiocommunication signal are analyzed, and the different types of algorithms, which are used in the professional environment for the prediction of signal reception conditions, are introduced and analyzed. These types of algorithms, both analytical and statistical, for both outdoor and indoor environments, are necessary in the planning phase of radiocommunication services.

The subject of Antennas & Propagation is not limited to theoretical knowledge, but rather, by carrying out practical work in laboratory projects, it allows the acquisition of the competences and knowledge required for the comparative analysis and design of radiant systems, and for the comparative analysis and implementation of algorithms for the prediction of radio propagation.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCES
The competences of Module M03 or "Sistemas de Telecomunicación" Module that should be acquired by students are the following ones:
-S03 Ability to analyze components and their specifications for guided and unguided communication systems.
-S04 Ability for the selection of circuits, subsystems and systems of radiofrequency, microwaves, radio broadcasting, radio links and radio determination.
-S05 Ability for the selection of antennas, equipment and transmission systems, propagation of guided and unguided waves, by electromagnetic, radiofrequency or optical means and the corresponding management of the radioelectric space and allocation of frequencies.

Moreover, the general competences of the degree that are developed in the subject are the following ones:
-G003 (Specific): Knowledge of basic subjects and technologies that enables students to learn new methods and technologies, as well as giving them great versatility to adapt to new situations.
-G004 (Transversal): Ability to solve problems with initiative, decision making, creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of Technical Telecommunications Engineering.

LEARNING RESULTS
Each student should acquire the following learning results in the subject:
-LR01: Identifies the fundamental parameters that define the properties of antennas in general and of each of the families of radiating systems, in particular, both for their analysis and for their design as elements of radioelectric systems.
-LR02: Selects the appropriate type or types of antenna, based on their specifications, to meet the requirements of the different communication systems in which their use is required.
-LR03: Certifies the performance and operation of radiant systems using simulation software and measurement instruments; correctly processes and analyzes the data obtained.
-LR04: Knows and applies the concepts related to radioelectric propagation mechanisms as well as deterministic and

empirical prediction algorithms, in different deployment environments of radiocommunication systems, both outdoor and indoor, to evaluate the availability of associated services, in their phase of planning.
-LR05: Expresses fluently, both in writing and orally with visual support, both individually and as part of teamwork, the procedures, results and conclusions derived from the learning outcomes described above.

Theoretical and Practical Contents

ANTENNAS and PROPAGATION program
Lesson 1
-Frequency bands and antenna types.
-Antenna parameters: input impedance, efficiency, radiation pattern, polarization.

Lesson 2
-Fundamentals of electromagnetic radiation. Radiation regions.
-Wire antennas: dipoles, monopoles, loop antennas, yagi antenna, log-periodic antenna, helical antennas.
-Antenna arrays.

Lesson 3
-Antenna arrays.

Lesson 4
-Slot antennas.
-Aperture antennas.
-Horns.
-Reflectors.

Lesson 5
-Propagation phenomena (diffraction, attenuation by gases, hydrometeors and clutter) and environments.
-Modes of propagation: groundwave, skywave and spacewave.
-Deterministic propagation methods: Friis and Ray tracing, Ikegami and ITU-R.
-Empiric propagation models, outdoor: log-distance, specific environment models, shadowing and fading.
-Fundamentals of empiric propagation models, indoor.

PRACTICAL LABORATORY WORK
1) Antenna characterization procedures. Measurements: radiation pattern, directivity, S21, S11 and impedance.

2) Several antenna types analysis and synthesis. Design and simulation.

3) Implementation of a propagation model and verification by means of comparison with measurements.

TEACHING METHODS

The lecturing hours of master classes will be devoted to explaining the theoretical background of each lesson, using slides and the blackboard for this purpose.
In the classroom-practice hours, problem-solving activities will be carried out, sometimes solely on the blackboard, sometimes with the aid of antenna-design software packages. All this will lay the groundwork of the concepts to be applied in the laboratory.
Laboratory projects will be carried out in two or three-people groups, and each group will have to deliver the required documentation regarding the results of the work. They will also have to do a presentation of them in order to be evaluated.

In the event that sanitary conditions prevent the realization of a face-to-face teaching activity and / or evaluation, a non-face-to-face modality will be set in place of which the students will be informed promptly.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	15	4,5	7,5	18					
Horas de Actividad No Presencial del Alumno/a	22,5	6,75	11,25	27					

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 60%
- Exercises, cases or problem sets 40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The total score of the subject is divided into two sections:
- 60 % of the total score: assessment of the written exam.
- 40 % of the total score: assessment of the practical laboratory work. This evaluation process includes both the evaluation of individual and group work.

Electronic devices such as calculators, smartphones, smartwatches, etc cannot be used in order to answer quizzes. For the rest of the exam only calculators are allowed.

To pass the subject it is required:
- To get a score equal to or greater than 5 points out of 10 on the written exam
and
- to get a score equal to or greater than 5 points out of 10 on the practical laboratory work.

Should this requirement not be fulfilled, the final total grade will be the grade obtained in the failed part.

Assessment of the written exam:
- Only final assessment.
* Written exam in the official examination hour: set of problems and/or questions.

Assessment of the practical laboratory work:
- Continuous assessment:
* There will be oral presentations by the working groups of the laboratory about the work carried out in the projects. Each project will be given a 0-to-10 grade, and each grade will determine a third of the final grade of the laboratory part. After each presentation, there will be a question time in which all the other groups than the one that has made the presentation will have to pose at least one question per group. Otherwise, all the members of the defaulting group will be penalized with a negative point over 10 in the grade of that particular project. One negative point per each due question. The question time will conclude with the questions and comments of the professor regarding both the technical contents and the formal aspects of the presentation. The conclusions from these questions and comments will be the basis of the grade of this project. A previously published rubric, made available to the students prior to the evaluation, will be used for this evaluation. Furthermore, after the evaluation of each project is completed, the following will be delivered to each concerned person: the scores of the evaluation of the practice, carried out according to the rubric, both individual and group based, with the corresponding justifications, and a set of general observations and improvements for all students in the class.

* Students have the right to resign to the continuous assessment in accordance with the procedure and established deadlines in Article 8.3 of Student Assessment Regulations of the UPV/EHU. Then they would be assessed following the final assessment procedure: they must report a written statement for such a claim, with a deadline of 9 weeks, starting from the beginning of the four-month period.
- Additional final assessment:
* Test exam about the laboratory projects after the first written exam (in the official examination date).
* Individual.

Declining to sit: not attending the final exam call will be considered equivalent to a withdrawal (no examination attempt is used) and a grade of NS.

In the event that sanitary conditions prevent the realization of a face-to-face teaching activity and / or evaluation, a non-face-to-face modality will be set in place of which the students will be informed promptly.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The total score of the subject is divided into two sections:
- 60 % of the total score: assessment of the written exam.
- 40 % of the total score: assessment of the practical laboratory work. This evaluation process includes both the evaluation of individual and group work.

Electronic devices such as calculators, smartphones, smartwatches, etc cannot be used in order to answer quizzes. For the rest of the exam only calculators are allowed.

To pass the subject it is required:
- To get a score equal to or greater than 5 points out of 10 on the written exam
and
- to get a score equal to or greater than 5 points out of 10 on the practical laboratory work.

Should this requirement not be fulfilled, the final grade will be the grade obtained in the failed part.

Assessment of the written exam:
- Students that got a score equal to or greater than 5 points out of 10 on the written exam of the previous call:
* It is possible to keep the score of the written exam of the previous call without having to take the written exam again.
- Students not fulfilling the previous condition:
* Written exam in the official examination hour: set of problems and/or questions.

Assessment of the practical laboratory work:
- Students that got a score equal to or greater than 5 points out of 10 on the practical laboratory work of the previous call:
* It is possible to keep the score of the practical laboratory work of the previous call without having to take the practical exam.
- Students not fulfilling the previous condition:
* Practical test exam after the written exam (in the official examination date).

Declining to sit: not attending the final exam call will be considered equivalent to a withdrawal (no examination attempt is used) and a grade of NS.

In the event that sanitary conditions prevent the realization of a face-to-face teaching activity and / or evaluation, a non-face-to-face modality will be set in place of which the students will be informed promptly.

MANDATORY MATERIALS

All the material is available on the eGela online teaching platform:
- PowerPoint slides for the lectures.
- Exercises to be worked on during the classroom practices.
- Guide notes of the practical laboratory work.

Deliverables will be made accessible through the online platform.

BIBLIOGRAPHY

Basic bibliography

C. A. Balanis, "Antenna Theory: Analysis and Design," John Wiley & Sons, 2016

C. A. Balanis, "Modern Antenna Handbook," John Wiley & Sons, 2008

W. L. Thiele y G. A. Stutzman, "Antenna Theory and Design," John Wiley & Sons, 2013

J. D. Kraus, "Antennas for all applications," McGraw-Hill, 2003.

All of them are available in the faculty Library.

Detailed bibliography

R. E. Collin, "Antennas and Radiowave Propagation," McGraw-Hill, 1985.
S. J. Orfanidis, "Electromagnetic Waves and Antennas," http://www.ece.rutgers.edu/~orfanidi/ewa/
J. Bolton, "An introduction to Maxwell's Equations," Open University, 2006.
J. Bolton, "Electromagnetic Fields," Open University, 2006.
J. Bolton, "Electromagnetic Waves," Open University, 2006.
D. M. Pozar, "Microwave Engineering," Addison Wesley, 2002.

Journals

IEEE Transactions on Antennas & Propagation.
IEEE Antennas and Wireless Propagation Letters.

IEEE Antennas & Propagation Magazine.
Microwaves and RF.

Web sites of interest

The evaluation versions of the software packages that will be used in the course can be found on the Internet:
MMANA-GAL: https://hamsoft.ca/pages/mmana-gal.php
Antenna Magus: https://www.3ds.com/products-services/simulia/products/antenna-magus/
TICRA GRASP: https://www.ticra.com/software/grasp/

Some free online apps for the analysis of certain types of antennas are also of interest:
-Dipoles: https://www.omnicalculator.com/physics/dipole
-Antenna arrays: https://antennaarraycalculator.blogspot.com/p/calculator.html
-Horn antennas: https://hornantennacalculator.blogspot.com/p/calculator.html

OBSERVATIONS

This teaching guide conforms to the "Normativa reguladora de la Evaluación del alumnado en las titulaciones oficiales de Grado" (BOPV nº 50 de 13-01-2017).

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27388 - Radar & Satellite Navigation Systems **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The subject 'Radar y Sistemas de Navegación por Satélite' is in 4th course, within the intensification on 'Telecommuication systems'. It is focused on the technologies that obtain positioning and additional information from objects, by means of the electromagnetic properties of the radio signals: Radar systems and Global Navigation Satellite Systems (GNSS).

In the syllabus, concepts from previous subjects related to radiocommunication systems, antennas and propagation are applied. The students must have basic knowledge of these topics.

The approach of the subject is quite practical. Theoretical concepts are applied to operational situations and specifications of real radars are used in the examples.

It is possible to make the exam in English. Basic materials are also available in English.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The student will learn different technologies used in the radar and GNSS systems. They will apply, in a practical way, concepts learnt in previous subjects about propagation, antennas and signal processing.

The student will work with these concepts in practical situations and representative examples.

Theoretical and Practical Contents

The basic contents of the subject are:
- Analysis of the radar signal in time and frequency domains.
- Understanding of the functionalities ans specifications of the subsystems that compose a generic radar system (antenna, transmission, reception, signal processing, anti-clutter techniques, ...)
- Main data processing techniques used in radar and GNSS
- Architecture of the GNSS
- Signals, data processing and services in GPS and Galileo

TEACHING METHODS

The core of the subject is described in the theoretical lecturers, where the main concepts and the approach of the practical exercises are described.

Additionally, practical problems describing representative situations will be faced by the students, by applying the concepts of the syllabus and technical specifications of real radars. The practical problems will be presented by the professor, both in theoretical lecturers and seminars, and solved by the students in working groups.

The lab practise will be focused in radar simulations related to selected concepts from the syllabus, with a software tool developed for that purpose. The students will write a short report for each individual practise, including the results and the analysis of the problem resolution.

Field practise will provide a close approach to real radar systems or to simulators of applications based on radar systems.

In case the sanitary conditions prevent from the planned teaching activity and/or the face-to-face evaluation, a non-face-to-face modality would be activated and the students would be informed promptly.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	15	7,5	7,5	10					5
Horas de Actividad No Presencial del Alumno/a	22,5	11,25	11,25	15					7,5

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

Evaluation methods

- Continuous evaluation

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 50%
- Exercises, cases or problem sets 20%
- Individual assignments 10%
- Teamwork assignments (problem solving, Project design) 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the subject will be as follows:
- An individual written exam about theoretical concepts and short practical questions, after the first weeks of the triannual (10%)
- Periodical reports of the exercises addessed in small groups, laboratory practises and the on-site practise, which should describe the developed analysis and the results to the questions (40%). The periodical reports must be handed over on time.
- A final written exam with theoretical questions and practical problems (50%). It is required to pass this final exam to pass the subject.

It is mandatory to complete all the laboratory practises and the practical problems developed in small groups, and to deliver the required reports in order to pass the subject.

The evaluation criteria are the following:
- Proper knowledge and comprehension of the main contents and concepts of the subject.
- Adequate relation of theoretical concepts, technological requirements and technological solutions
- Adequate application of the previous items to specific representative situations
- Accuracy of the quantitative results of practical examples

Students that choose not to participate in partial exams must notice this fact to the professor at least one week before the first partial trial. Otherwise, they will be evaluated in the partial exams, even if they are not present in the trial.

Students that choose not to participate in partial exams will be alternatively evaluated in a unique final written exam, based on the most relevant theoretical concepts, practical questions and exercises, for the 100% of the grade.

In case that health conditions prevent from the scheduled activities and/or the on-site examination, online alternatives will be launched and students will be punctually informed.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation will consist of a final exam composed by a written exam containing the most relevant theoretical concepts, practical questions and problems.

In case that health conditions prevent from the scheduled activities and/or the on-site examination, online alternatives will be launched and students will be punctually informed.

MANDATORY MATERIALS

The resources for the students are:
- Syllabus of the subject
- Exercises, practical problems and representative examples
- Practical cases, technical specifications of radars
- User manual of the software tool for lab simulations
- Additional bibliography

These resources will be available at virtual room for the students E-Gela.

BIBLIOGRAPHY

Basic bibliography

- Introduction to Radar Systems, M.I. Skolnik, McGraw-Hill Book Co., Singapur, 1980
- GNSS Data Processing, ESA TM-23, Vol I: Fundamentals and Algorithms (disponible en www.navipedia.net/GNSS_Book/ESA_GNSS-Book_TM-23_Vol_I.pdf)
- GNSS tutorials

Detailed bibliography

- Monopulse principles and techniques, S. M. Sherman, Artech House, 1984
- Principles of Modern Radar, J.L. Eaves et al.
- Radar Principles, N. Levanon.
- Radar System Design and Analysis, S.A. Hovanessian, Artech House Inc., USA, 1984

- Guía práctica del GPS, P. Correia, Marcombo.
- The GPS Manual. Principles and Applications, S. Dye, Baylin Publications
- Documentación sobre el sistema GPS publicada por el DoD de EEUU (disponible en E-gela)
- Documentación sobre el sistema Galileo publicado por la Agencia Espacial Europea (disponible en E-gela)

Journals

Web sites of interest

http://www.navipedia.net/
http://www.gps.gov/
http://www.esa.int/galileo
http://www.esa.int/Our_Activities/Navigation/The_present_-_EGNOS/What_is_EGNOS
http://egnos-portal.gsa.europa.eu/

OBSERVATIONS

Universidad del País Vasco Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27389 - Microprocessor-based Designs **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The objective of this subject is to initiate the student in the analysis of the characteristics of different microprocessors to select the most suitable one, for the design that must be done.
There are some design requirements that must be fulfilled. Focusing on the microprocessor and adding the necessary elements, the design of a product (hardware and software) will be completed.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Capacity to design analog and digital electronics devices, analog-digital and digital-analogue conversion, radio frequency, power and conversion of electrical power for telecommunication and computer applications.

Capacity to carry out the specification, implementation, documentation and set-up of electronic, instrumentation and control devices and systems, considering both the technical requirements and the corresponding standard regulations.

Therefore, the student acquires the ability to select advanced microprocessors, electronic components and integrate them into a digital system based on a microprocessor, in order to create a product, that fullfill the specification. Tjey also acquires the ability to configure and program the microprocessor for the required functionality.
It uses the concepts of analogue and digital electronics of other subjects of the degree.

Modern microprocessors compete designing complex systems, with FPGA and DSP. So it is necessary to analyze points as computational speed and performance, use of memory, processor, coprocessors and peripherals performance, bus organization and compiler efficiency.

Much of the effort is dedicated to the design of the program: computer tools for editing, compiling, debugging, simulating, linking and loading in memory, configuration of peripherals, C-programming, auxiliary libraries, real time execution.

Objective: To give the students the capacity to design and develop digital circuits based on microprocessors of great computing capacity

Theoretical and Practical Contents

1. Introduction to systems based on advanced microprocessor
2. Detailed Knowledge of microprocessors: kernel, memories, interrupts, timers, I/O ports, Peripheral.
3. Design of a product based on a microprocessor.
4. Design Flow of a complex digital system. Development and debugging Tools.
5. C Programming oriented to microprocessor.
6. Complete development of a microprocessor program to load into it.
7. The microprocessor's electronic card: physical and electrical aspects.

Practices
-Analysis and comparison of microprocessors.
-Product Design with microprocessors.
-Study of a micro of the family Kinetis.
-Knowledge of the development environment.
-Study of the evaluation card.
-Development of a program on the evaluation card:
  Debugging.
  Loading and executing on the card.
  Management of the main parts of the
-Free Work with the microprocessor

TEACHING METHODS

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	7,5			12,5	25				
Horas de Actividad No Presencial del Alumno/a	11,25			18,75	37,5				

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Exercises, cases or problem sets 15%
- Teamwork assignments (problem solving, Project design) 65%
- Oral presentation of assigned tasks, Reading¿ 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Continuous Evaluation: All parts must be approved separately.
The waiver of the continuous evaluation shall be carried out as set out in the corresponding evaluation regulation.

The Final examination will count 100%, and include a theoretical and practical part in the laboratory.
The procedure for waiving a call will be the one included in the corresponding legislation.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

It will Be done by final test that and includes a theoretical and practical part in the laboratory.
The same criteria as in the ordinary call Will Be followed

MANDATORY MATERIALS

Kinetis KwikStik evaluation board

BIBLIOGRAPHY

Basic bibliography

-Kinetics user´s and instructions manual
-Codewarrior manual

Detailed bibliography

Journals

Web sites of interest

www.freescale.com/Kinetis
www.freescale.com/codewarrior

OBSERVATIONS

The teaching material is available on the eGELA platform.

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GTELEC30 - Bachelor's Degree in Telecommunications Engineering **Year** Fourth year

COURSE

27833 - Telecommunications Circuits (2) **Credits, ECTS:** 4,5

COURSE DESCRIPTION

This subject continues the work developed by the subject Electronic circuits, which is focused on other more basic analogue subsystems and on the operation of the operational amplifier. Telecommunication circuits delves into the acquisition of competencies related to these and other more complex electronic systems, such as analogue multipliers, oscillators and phase locked loops, and various circuits based on the usage of operational amplifiers.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

This subject works the following module (M05SE) competencies:
M05SE2 Ability to select specialized electronic circuits and devices for transmission, routing and terminal configuration, in both fixed and mobile environments.
M05SE5 Ability to design electronic analogue and digital circuits, analogue-digital and digital-analog conversion, radiofrequency circuits, power management and electric energy conversion for telecommunication applications and computing.
M05SE6 Ability to understand and use the feedback theory and control of electronic systems.
Students will acquire the ability to select specialized electronic circuits and devices for telecommunications; design basic circuits; understand and use feedback theory and control of electronic systems.

Theoretical and Practical Contents

Contents, list of topics:
1. Circuits with operational amplifiers (instrumentation amplifier, current sources, boosters, feedback, compensation)
2. Power amplifiers
3. Timers
4. Oscilators
5. Multiplier circuits and wave shaping circuits
6. Phase locked loops
7. A/D and D/A converters

TEACHING METHODS

In this subjects, master classes (3 credits) are complemented with the implementation of various practices (1.5 credits) for the design, simulation and assembly of the electronic circuits under study.
Not face-to-face teaching will be devoted to the preparation of the master classes, search for information, consultation of specification sheets and application notes, and the preparation of the electronic project to be carried out in the laboratory.
Attendance to laboratory practices is mandatory.
In the event that sanitary conditions prevent the carrying out a teaching activity and / or face-to-face assessment, a non-contact modality will be activated and the students will be informed promptly.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	30			15					
Horas de Actividad No Presencial del Alumno/a	45			22,5					

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 60%
- Individual assignments 20%
- Teamwork assignments (problem solving, Project design) 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Composition of the final grade. It consists of three parts:
60% written final exam (FINAL TEST)
20% continuous evaluation of the laboratory project (PROJECT LAB)
20% reports of the design and simulation exercises proposed (INDIVIDUAL EXERCISES)

To pass the course will require that all three parts that make up the final mark are passed.
The deadline for renouncing continuous assessment will be that set by UPV/EHU regulations.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the second call will have the same composition as the ordinary call.
The notes of individual exercises and laboratory project will be saved, if approved in the ordinary call, for the extraordinary session.
Students who have not passed the part corresponding to the individual exercises or the lab project will have a complementary test to evaluate those contents.

MANDATORY MATERIALS

Presentation notes used in classes.
Notes of the laboratory project.
This course has a MOODLE web page (eGela).

BIBLIOGRAPHY

Basic bibliography

A.B. Wiliams. Designer’s Handbook of Integrated Circuits. McGraw Hill, 1984.
A.S. Sedra, K.C. Smith. Microelectronic Circuits. Oxford, 2017.
S. Franco. Design with O.A. and Analog I.C. McGraw-Hill, 2001.
T.C. Carusone et al. Analog Integrated Circuit Design. Wiley, 2011.
R. Mancini. Op Amps for everyone. Texas Instruments. 2001.
W. Jung, Op Amp Applications Handbook, Newnes, 2006.

Detailed bibliography

S. Soclof. Design and Applications of Analog Integrated Circuits. Prentice-Hall, 1991.
R.E. Best, Phase-locked loops : design, simulation, and applications, McGraw-Hill, 2003.
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J.G. Graeme. Designing with Operational Amplifiers. McGraw Hill, 1977.
J.G. Graeme, G.E. Tobey y L.P. Huelsman. Operational Amplifiers. Design and Applications. McGraw Hill, 1971.
Y.J. Wong y W.E. Ott. Function Circuits. Design and Applications. McGraw Hill, 1976.
Nonlinear Circuits Handbook. Analog Devices, 1976.

Journals

Manufacturers specification datasheets

Web sites of interest

OBSERVATIONS

This course has a MOODLE web page (eGela).

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 345 - Faculty of Engineering - Bilbao **Cycle** .

Degree GIAMBI30 - Bachelor's Degree in Environmental Engineering **Year** Fourth year

COURSE

27440 - Environmental Management in Industry **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The main aim of the course is to provide knowledge of the design, implementation and evaluation of environmental management systems in industry, as well as other environmental management tools useful to reduce the impact of industrial activities and to report on their commitment to do so.
This course is taught during the last semester of the Degree. It requires previous knowledge acquired in basic and specific courses, in particular in "Environmental Science and Technology". "Environmental Management in Industry" is an optional course, but compulsory in the "Environmental Management" specialization. However, this course is useful for students of any variation of the Degree in Environmental Engineering, as well as Chemical Engineering, Civil Engineering and Industrial Engineering, among others.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The competences acquired in the course will allow students to:
-Describe and argue the benefits of implementing an environmental management system in organizations, in particular in the industrial sector.
-Detail the main features and applications of existing environmental tools in order to implement an environmental management system.
-Identify the main steps in order to plan, design, implement, assess, and improve an environmental management system.
-Describe the fundamentals and applications of other useful environmental management tools such as life cycle assessment, eco-design, environmental footprint, ecolabelling and others.

Theoretical and Practical Contents

The main contents of the course comprises four topics:
-Topic 1. Business and Environment. Introduction to Environmental Management Systems (EMS) in an organization.
-Topic 2. Environmental Management Systems. Context. Standardised environmental management systems. Implementation of Environmental Management Systems. Integrated management systems. Environmental indicators. Communication: environmental statement.
-Topic 3. Environmental audits. Definition, scope and objectives. Types of environmental audits. Content and methodology of an environmental audit. Communication: the audit report.
-Topic 4. Other environmental management. Life Cycle Assessment. Ecodesign. Environmental footprint. Product and organisation environmental footprint. Specific footprints: carbon footprint, water / hydric footprint, ecological footprint. Ecolabelling. Sustainability reports

TEACHING METHODS

The course will be delivered by means of:
-Lectures (MC), which will be used to explain core contents in order to develop students' knowledge and understanding of the aforementioned concepts.
-Seminars (S), which will be used for practical activities, discussions in groups, reviews, etc..
-Computer labs (CL), which will be used to solve practical cases and to prepare an individual report that will be presented to the group at the end of the semester.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	22,5	15			7,5				
Horas de Actividad No Presencial del Alumno/a	33,75	22,5			11,25				

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

- Multiple choice test 40%
- Exercises, cases or problem sets 20%
- Individual assignments 35%
- Oral presentation of assigned tasks, Reading¿ 5%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Continuous assessment is used in both ordinary and extraordinary assessment sessions. The completion of activities, computer lab reports and the exposition are included in the assessment criteria (60%). Students are also required to take a final written exam in May/June (40%). It is essential to pass this final exam (minimum grade: 5.0/10.0) to average it with the grades obtained during the semester (activities, computer lab reports and oral defence:
Any student wishing to waive continuous evaluation and wishing to be marked by final assessment instead of by continuous assessment in the ordinary session should request this in a written document from the lecturer responsible for the course before the ninth week after the course starts. In this case, the student must do the following in May/June:
-Written exam: multiple choice test (40% of final grade)
-Resolution of a practical case (50% of the final grade)
-Computer lab test (10% of the final grade)

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students who do not pass the subject in the ordinary call are required to take a written exam similar to that in the ordinary session (40% of the final mark). The remaining 60% of the mark will correspond to the activities carried out throughout the semester (practical activities, computer lab reports and oral presentation).
Any student who requested to be qualified by final assessment in the ordinary session will be marked according to the same criteria as in the ordinary session.

MANDATORY MATERIALS

Materials required to follow the sessions will be shared with the students though eGela virtual platform (https://egela.ehu.eus/):
-Lecture materials and documents,
-Instructions for practical activities and computer lab guides,
-Links to useful websites and useful reports.

BIBLIOGRAPHY

Basic bibliography

This section contains a basic bibliography in English (resources in Spanish are included in the corresponding guide in Spanish).
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- Jackson, S. L. (1997). The ISO 14001 implementation guide: creating an integrated management system (Ser. Wiley series in environmental quality management). Wiley.
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Standards.
- ISO 14001:2015. Environmental management systems — Requirements with guidance for use.
- ISO 14006:2011. Environmental management systems — Guidelines for incorporating ecodesign.
- ISO 14040:2006. Environmental management — Life cycle assessment — Principles and framework.
- ISO 14064-1:2018. Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.
- ISO 19011:2018. Guidelines for auditing management systems.

Detailed bibliography

- Eco-Management and Audit Scheme. Available at: https://ec.europa.eu/environment/emas/pdf/factsheets/EMAS_revised_annexes.pdf Last accessed: June 2022.
- European Commission, EC (2017). Moving towards a circular economy with EMAS. Best practices to implement circular economy with EMAS. Best practices to implement circular economy strategies (with case study examples). Available at: https://ec.europa.eu/environment/emas/pdf/other/report_EMAS_Circular_Economy.pdf Last accessed: June 2022.
- Hauschild, M. Z., Rosenbaum, R. K., Olsen, S. I. (2018). Life cycle assessment : theory and practice. Springer International Publishing (ebook available).
- Machado, C., Davim, J. P. (2020). Circular economy and engineering: a new ecologically efficient model (Ser. Management and industrial engineering). Springer.
- Public Society for Environmental Management of the Basque Government – IHOBE (2002). Manual on Ecodesign. 7 steps for implementation. Available at: https://www.ihobe.eus/publications/manual-on-ecodesign-7-steps-for-implementation Last accessed: June 2022

- Public Society for Environmental Management of the Basque Government – IHOBE (2016). 36 Circular economy demonstration projects in the Basque Country Available at: https://www.ihobe.eus/publications/36-circular-economy-demonstration-projects-in-the-basque-country Last accessed: June 2022.

Journals

- Environmental Management. Editorial Springer. Available at: https://link.springer.com/journal/267. Last accessed: June 2022
- Journal Environmental and Sustainability Indicators. Editorial Elsevier. Available at: https://www.journals.elsevier.com/environmental-and-sustainability-indicators. Last accessed: June 2022
- Journal of Environmental Management. Editorial Elsevier. Available at: https://www.journals.elsevier.com/journal-of-environmental-management Last accessed: June 2022

Web sites of interest

- Basque Government. Department of the Environment, Territorial Planning and Housing. http://www.euskadi.eus/gobierno-vasco/departamento-medio-ambiente-politica-territorial/inicio/
- Eur-lex. Access to the Official Journal of European Union Law http://europa.eu.int/eur-lex/
- European Environment Agency (EEA) http://www.eea.eu.int
- International Standards Organization (ISO) http://www.iso.org
- Ministry for Ecological Transition and Demographic Challenge - MITECO, Spanish Government https://www.miteco.gob.es/es/
- Public Society for Environmental Management of the Basque Government – IHOBE http://www.ihobe.es
- Spanish Association for Standardization and Certification - AENOR http://www.aenor.es
- United States Environmental Protection Agency (EPA) http://www.epa.gov

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GIEIAU30 - Bachelor's Degree in Industrial Electronics and Automation Engine **Year** Fourth year

COURSE

27684 - Project Management **Credits, ECTS:** 6

COURSE DESCRIPTION

The subject "Project Management" has been changing its name along with the successive changes of study programmes; it has been called "Technique Office and Projects", "Technique Office" only and "Projects" only. However, it has maintained its fundamental educational objective: to develop the capacity to the student to elaborate technique projects and all the functions related to them. In fact, it is directly focused on the elaboration of his "Grade Final Work"; after its successful presentation, it is when he will be able to fully execute his profession, with the corresponding professional attributes for his speciality, legally regulated.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Methodology, organisation and project management.

Theoretical and Practical Contents

THE ENGINEERING Competences and environment of industrial engineering
GENERAL THEORY OF THE PROJECT General theory of the Project and its application in engineering projects
ENGINEERING PROJECTS AND NORMALISED DOCUMENTATION Generation of engineering projects and reports. The Technique Office and the development of Normalised Documentation.
PROJECT MANAGEMENT Engineering project management. Basic knowledge and its application in computer systems. The quality in Project Management.

TEACHING METHODS

Both in lecture-based and computer-based teaching theoretic-practical activities could be made if necessary.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	15				45				
Horas de Actividad No Presencial del Alumno/a	22				68				

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 30%
- Exercises, cases or problem sets 30%
- Teamwork assignments (problem solving, Project design) 40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Continuous evaluation of the student work and the competences worked (individual and in group, in-person and non in-person) by weighting the following aspects or tasks:
1. EXAMS (30%). Indispensable achieving evaluation criteria to weight the qualification.
2. TEAM WORK (40%): Technique project. Indispensable achieving evaluation criteria to weight the qualification.
3. PRACTICES (30%). Indispensable achieving evaluation criteria to weight the qualification. Those could be part of the team work, applied to the project management.

Laboratory-based exercises and the proposed deliverables, related with the contents and competences of the subject, are compulsory and subjected to continuous evaluation. In order to be qualified, it is necessary to present the proposed works in the form and dates proposed by the lecturer responsible of the subject. So as to not distort the principles of the continuous evaluation and competence-based teaching, those students that have not presented laboratory-based exercises and deliverables on time, will not have the possibility of presenting them later.
In the continuous evaluation, those students that are not presented to the final exam will be considered as NOT PRESENTED; otherwise, they will be considered PRESENTED.
ORDINARY CALL AND EXCEPTIONAL CASES (art. 43 of the current normative)
Those students that are presented to the ordinary call (and the exceptional cases) will have a unique final exam. This could include parts related to laboratory-based exercises and deliverables done during the course or others similar to those, since they form part of the contents developed in the normal development of the subject.

In the event that health conditions prevent the completion of a teaching activity and/or face-to-face assessment, a non-face-to-face modality will be activated, of which students will be promptly informed.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Exam 30%, Project 70%. It is necessary to pass both of them to achieve a positive evaluation.

MANDATORY MATERIALS

eGela platform of UPV/EHU.

BIBLIOGRAPHY

Basic bibliography

PMI. "A guide to the Project Management Body of Knowledge (PMBoK) 6th edition", 2017.
Alonso Girón J.M. La Oficina Técnica. Los Autores Bilbao 2000.
Santos Pera J.A. Pérez Manso A. Ingeniaritza-Proiektuak: Proiektuaren Teoria Orokorra dokumentazio Arautua eta Kudeaketa - Artekopi S.L. Bilbao 2008
Cos del Castillo Teoría General del Proyecto. ED Síntesis. Madrid 1997
Gómez García J.F. Gestión de Proyectos. Ed FC Madrid 2000
PMI Standard Commitee. Fundamentos de la Dirección de proyectos. AEIPRO. Madrid 2001

Detailed bibliography

Wiest J.D. Técnicas CPM y PERT ed. Paraninfo. Madrid 1972
Romero López C. Programación y control de Proyectos. Ed. Pirámide. Madrid 1983.
Morilla Abad I. Guía Metodológica y Práctica de la Realización de Proyectos. C.I.C.C y Puertos. Madrid 1986
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Santos Sabrás F. Ingeniería de Proyectos. Eunsa. Pamplona. 1999.
Sevilla López J.M. Manual Para la Redacción de Proyectos en la Administración Pública. CIE Dossat 2000. Madrid 2000.
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Ley de Contratos de las Administraciones Públicas¿. (BOE 129, 95/5/19)

Journals

International Journal of Project Management.
IPMA - Newsletters
Técnica Industrial.
Dyna - Ingeniería e Industria.
IMHE
Electronic Designs
Ingeniería Química
Era Solar

Web sites of interest

http://www.aeipro.com/
http://www.ipma.ch/Pages/default.aspx
http://www.4pm.com/
http://www.pmi.org/Pages/default.aspx
http://www.elsevier.nl/locate/inca/30435

OBSERVATIONS

This guide collects basic guidelines of common application to all the faculty of the subject. Later, each docent could provide to his students a "group subject guide" with more detailed information.

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GMECAN30 - Bachelor`s Degree in Mechanical Engineering **Year** Fourth year

COURSE

27728 - Computational Fluid Mechanics **Credits, ECTS:** 6

COURSE DESCRIPTION

In this course, you learn the operation and use of Computational Fluid Dynamics (CFD) codes. Interest in numerical methods in engineering is increasing, both in the scientific and industrial spheres, especially as the computational capacity of the equipment increases, and they are able to solve complex models such as the equations that govern the flows of fluids.

The approach of the course is very applied, and its development requires basic knowledge of Fluid Mechanics and Numerical Methods acquired in previous courses. The tasks that will be developed in this course will allow the students to face a simulation of a CFD problem and choose the appropriate parameters to obtain satisfactory results in certain quality and term. For this, the basic understanding of the Finite Volume Method and different discretization approaches of the governing equations is necessary. The course complements the knowledge acquired throughout the Bachelor's Degree in Mechanical Engineering in a state of the art discipline, such as CFD which is demanded by many different sectors: Automotive, Energy, Construction...

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

1. Know, understand and apply the concepts of the science and technology of computational fluid mechanics in order to be able to adapt to new situations. (C3).
2. Perform measurements, calculations, studies and reports on the operating parameters of different types of fluid installations (C5).
3. Ability to work in a multilingual environment (C10).
4. Adopt a responsible, orderly attitude to work and be willing to learn the concepts of numerical resolution of fluid dynamic problems, considering the challenge of the necessary continuous training (C12).
5. Apply the strategies of scientific methodology: analyse the problematic situation qualitatively and quantitatively, propose hypotheses and solutions to solve fluid mechanics problems (C13).
6. Knowledge and skills to apply computer-assisted graphic engineering techniques (TEM 1).
7. Applied knowledge of thermal engineering (TEM3).
8. Applied knowledge of the fundamentals of fluid-mechanical systems and machines (TEM 6).

Theoretical and Practical Contents

Summary of contents: Solution of Fluid Mechanics problems addressed and solved by numerical methods, which implies the use of computer calculation systems.

The theoretical contents:
1- Philosophy and field of application of computational fluid dynamics.
2- Equations that govern the flow: continuity, momentum and energy.
3- Mathematical considerations of differential equations. Generalities. Differential equations: hyperbolic, parabolic and elliptical. Simplifications of the Navier-Stokes equation.
4- Preliminary discretization techniques. Discretization. Approximation of the derivatives. Accuracy of the discretization process. Implicit and explicit approach. Theoretical framework: convergence, stability, accuracy of the solution.
5- Brief notes on the theory of similarity. Physical meaning of the dimensionless numbers.
6- Turbulent flow. Reynolds equations averaged over time. Equation models of turbulent kinetic energy. Boundary layer.
7- Basic computational methods applied to incompressible flow. Resolution of the transport equation. Methods to solve the current function. Boundary conditions. Methods to solve the pressure-velocity equation.
8- Basic computational methods applied to compressible flow. Methods for the numerical treatment of shock waves.
9- Generation of meshes and adequate transformations of the equations
10- Multiphase flow. Eulerian and Lagrangian approximation. VOF method (volume of Fluid)

The practical contents:
1- User-level learning of a commercial code of computational fluid dynamics.
2- Application of the theoretical concepts in practical exercises of computer simulation of real fluid mechanics problems. Comparison tests in laboratory vs. Simulation.

TEACHING METHODS

In this course, different teaching methodologies are used, the most used being problem solving. Individual and in couple work will be enhanced through the use of computer and bibliographic resources that help students understand the different

aspects of the subject.

Master lectures on the conceptual contents of the subject will be taught, with student participation in occasional debates about those contents.

The resolution of issues and problems in the classroom will be done in a participatory manner. Real problems will be provided, which will deepen the theoretical knowledge of the subject and relate the CFD with other related areas. The formulation of questions and open discussion will be encouraged, so that students acquire skills related to oral communication, the ability to synthesize and work in teams.

In computer practices, the concepts studied will be applied to real cases using a commercial program of Computational Fluid Dynamics.

To facilitate and ensure student learning, successive reports will be delivered on the problems raised. Evaluation feed-back will be provided, so that students have the opportunity to become aware of their learning, as well as ways to improve it.

In the event that health conditions prevent the performance of a teaching activity and/or evaluation in person, a non-presential modality will be activated of which the students will be informed punctually.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	15		30		15				
Horas de Actividad No Presencial del Alumno/a	22,5		45		22,5				

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Exercises, cases or problem sets 10%
- Individual assignments 10%
- Teamwork assignments (problem solving, Project design) 80%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students will be graded through a process of continuous assessment of the different tasks developed throughout the course as follows:

1. Practical work (Tutorials, Exercises): 10%
2. Deliverables of questions and small problems: 10%
3. Projects, problems and individual and group work. Directed tasks (works of greater complexity under the guidance of the teacher): 80%.

The following condition will apply: It is necessary to attend 80% of the classroom hours in order to be graded, otherwise it will be graded as "not presented".

In the event that health conditions prevent the completion of a teaching activity and/or face-to-face assessment, a non-face-to-face mode will be activated, of which students will be promptly informed.

Students who, at the beginning of the course, justify any of the reasons listed in article 43.1.c of the EHU/UPV regulations for the management of undergraduate studies, may obtain 100% of the mark by means of a theoretical-practical exam.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

For students who have taken part in the continuous assessment and have not passed the course, a final exam will be held in addition to the work done throughout the course.

For students who have NOT taken part in the continuous assessment, 100% of the mark may be obtained by means of a theoretical-practical exam. In these cases, it is necessary to contact the teacher at least one month before the date of the

exam.

In the event that health conditions prevent the completion of a teaching activity and/or face-to-face assessment, a non-classroom mode will be activated, of which students will be promptly informed.

MANDATORY MATERIALS

Course lecture notes.
Tables and diagrams of Fluid Mechanics course (2nd year).
Star CCM+ User Guide.

BIBLIOGRAPHY

Basic bibliography

ANDERSON, J.D.: "Computational Fluid Dynamics. The Basics with Applications". McGraw-Hill, 1995
CHUNG, T.J.: "Computational Fluid Dynamics". Cambridge University Press, 2002.
WILCOX, D.C: "Turbulence Modeling for CFD" ISBN 0-9636051-0-0. Library of Congress Cataloging in Publication Data, 1994.

Detailed bibliography

VERSTEEG, H.K. y MALALASEKERA, W.:"An Introduction to Computational Fluid Dynamics".Pearson, 1995, 2007.
ANDERSON, J.D.: "Computational Fluid Dynamics. The Basics with Applications". McGraw-Hill, 1995
CHUNG, T.J.: "Computational Fluid Dynamics". Cambridge University Press, 2002.
WILCOX, D.C: "Turbulence Modeling for CFD" ISBN 0-9636051-0-0. Library of Congress Cataloging in Publication Data, 1994.

Journals

Web sites of interest

www.cfd-online.com

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GIIGSI30 - Bachelor's Degree in Computer Engineering in Management and In **Year** Fourth year

COURSE

27709 - Systems Administration **Credits, ECTS:** 6

COURSE DESCRIPTION

This module is a follow-up to the content presented in the 2nd year "Introduction to Operating Systems" and 3rd year "Database Administration" modules, where students have used Linux-based systems at user level and conducted basic administration tasks.

The main goal of Systems Administration is to present a set of tools and techniques, both classic and modern, to manage users, files and software in Linux-based environments. In order to take this module, students should previously have:
• Basic command of the Unix/Linux shell.
• Understanding of how TCP/IP computer networks work.
• Understanding of basic computer architecture.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

On completion of the module a student should be able to:
• Manage users and groups in Linux-based environments, both at local and network level.
• Set up services to manage users and files Linux-based computer networks.
• Deploy virtualisation and container technologies to manage software in Linux systems.
• Configure container orchestration technologies.
• Process and analyse logs from a Linux system.
• Understand the fundamentals of Cloud Computing.

Theoretical and Practical Contents

This module is arranged in the following topics:

1. Local administration: User/file management and shell scripting in Unix/Linux systems.
2. Network services: Services to manage files and users in a Linux network.
3. Virtualisation and containers: Tools to manage and distribute software.
4. Container orchestration: Tools to manage the distributed execution of software containers.
5. Log analysis: Tools to ingest, analyse and visualise logs from a Linux system.
6. Introduction to Cloud Computing: Basic user and resource management in the Cloud.

TEACHING METHODS

Theory and practice sessions.

TYPES OF TEACHING

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

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 60%
- Individual assignments 40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students can choose to be assessed in two ways: continuous or final. By default, every student is assess in the continuous way.

Students assessed in the continuous way will get their grade from:
• 60% of the grade: Practical exams in which students will have to solve several exercises like those presented

throughout the module.
• 40% of the grade: Development of an individual assignment in which students will have put in practice virtualization, containerization and orchestration techniques.

Students who choose final assessment will get their grade based on a single exam at the end of the module. This exam has a written part related to the theoretical aspects of the module (50% of the grade) and a practical part with exercises similar to those done in the practice sessions (50% of the grade).

For more information, get in touch with the teaching staff.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

For more information, get in touch with the teaching staff.

MANDATORY MATERIALS

All the necessary material will be available at the university's eGela platform.

BIBLIOGRAPHY

Basic bibliography

- The Linux Philosophy for SysAdmins: And everyone who wants to be one. David Both. 2018. https://www.apress.com/us/book/9781484237298

Detailed bibliography

- Systems Performance: Enterprise and the Cloud, 2nd Edition. Brendan Gregg. 2021. http://www.brendangregg.com/systems-performance-2nd-edition-book.html
- The Kubernetes Book (Updated Feb 2020). Nigel Poulton. 2020. https://nigelpoulton.com/books

Journals

Web sites of interest

- docker.com
- kubernetes.io
- phoronix.com
- stackoverflow.com

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GIIGSI30 - Bachelor's Degree in Computer Engineering in Management and In **Year** Fourth year

COURSE

27710 - Professionals Aspects of Computer Science **Credits, ECTS:** 6

COURSE DESCRIPTION

The objective of this subject is to collaborate in the comprehensive training of the student with general professional skills, not strictly technical, that every engineer in any area should have for the correct exercise of their profession, thus facilitating professional incorporation in the area of Information Technology.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Reflect on professional ethics and deontology, as well as learn about related institutions and laws. Training for expertise and auditing in computer science. Training to work in development teams through the use of collaborative tools. Properly write technical reports. Successful presentations in public.

Theoretical and Practical Contents

Introduction
Social Aspects: Social Impact of Computing
Ethical Aspects: Ethics and Professional Responsibility
Legal Aspects: Computer Law, Personal Data Protection, Software Protection, Intellectual Property, Electronic Commerce, Web, LSSI, Computer Crime
Professional Aspects: Computer Expertise, Computer Audits, Group Work, Collaborative Tools

TEACHING METHODS

In each subject the basic concepts will be explained and later the students will have to deepen in each case with exercises or works.

TYPES OF TEACHING

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

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

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Exercises, cases or problem sets 40%
- Teamwork assignments (problem solving, Project design) 60%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students will have to pass a test with basic concepts of the subject. Once the test has been passed, the grade will be based on the work and exhibitions that the students will carry out in class.

Any student who does NOT take the basic concepts test will be graded as NOT PRESENTED.

Students who, in compliance with current regulations, and after the center's permission obtain a final test, will have to take the basic concepts test plus a written test with cases and theory related to the subject.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The student will have to take an exam that will account for 100% of the grade and will cover sections A, B, C and D, except those that were approved in the ordinary call.

MANDATORY MATERIALS

The material provided to students on the Moodle platform.

BIBLIOGRAPHY

Basic bibliography

BARROSO, Porfirio. Etica Y Deontologia Informatica. Fragua, 2006
Carlos Barriuso Ruiz. Interacción Del Derecho Y La Informática. Dykinson, 1996
Ull Pont, Eugenio. Legislación Informática. Uned, 2003

Detailed bibliography

Vázquez Dodero Juan Carlos y Albert Domingo. Las nuevas tecnologías y los equipos humanos: el nuevo escenario. Harvard Deusto Business Review, 2001

Journals

Web sites of interest

http://www.agpd.es
http://www.pmi.org

OBSERVATIONS

Universidad del País Vasco Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GIIGSI30 - Bachelor's Degree in Computer Engineering in Management and In **Year** Fourth year

COURSE

27711 - Data Mining **Credits, ECTS:** 6

COURSE DESCRIPTION

* OBSERVE: THIS COURSE IS SET AS AN English Friendly Course (EFC): Spanish is the teaching-medium.
Both the lectures and the main teaching-material are in Spanish. However, student-interventions in English are welcome in class.
The lecturers are willing to tutor, conduct examinations and/or accept results, works and e-mails in English.
The course aims at international students with either a good command of Spanish or a medium level of Spanish and good command of English.

Good programming skills are required as well as basic statistics.

Related topics:
- computation
- statistics and operative research
- machine learning
- artificial intelligence
- business intelligence
- decision support systems

CONTEXTO DE LA ASIGNATURA EN EL GRADO:
Esta asignatura se enmarca dentro del grupo de asignaturas que trabajan las competencias específicas del Móudulo Sistemas de Información (M03). Concretamente, trata de conocer el potencial, la problemática y la tecnología de análisis y extracción de conocimiento sobre sistemas de información, así como las técnicas de almacenes de datos para facilitar el procesamiento analítico de apoyo a la toma de decisiones estratégicas. También se aplicarán las técnicas de minería de datos apropiadas para problemas concretos de extracción de conocimiento.

RELACIONES CON OTRAS ASIGNATURAS
La asignatura tiene una fuerte componente práctica que recomienda un nivel alto de programación y una base de estadística. Se recomienda haber superado los siguientes cursos:
- Programación Modular y Orientación a Objetos
- Estructuras de Datos y Algoritmos
- Métodos Estadísticos de la Ingeniería
- Investigación Operativa

RELACIÓN CON EL ÁMBITO PROFESIONAL: La Minería de Datos contribuye en el desarrollo de competencias profesionales brindando herramientas para buscar la racionalidad cuando se requiere encontrar la solución a problemas en el marco del Business Intelligence. Comercio electrónico, entorno de soporte a las decisiones, riesgo y valoración. Son técnicas muy arraigadas en el mercado de gestión y análisis de datos en el marco empresarial. También se aplicarán las técnicas de minería de datos apropiadas para problemas concretos de extracción de conocimiento. La Minería de datos se ubica en el área de Inteligencia Artificial, que aplicada a la empresa se conoce como Business Intelligence. Ejemplos destacables de empresas donde se requieren las competencias que se trabajan en esta asignatura:
- ChatGPT
- IBM Watson Project
- Google (Big Data Tools)
- Oracle (Data Mining Libraries)

Temas afines:
- computación
- estadística e investigación operativa - sistemas de apoyo a la decisión
- inteligencia artificial
- aprendizaje automático
- business intelligence

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

* OBSERVE: THIS COURSE IS SET AS AN English Friendly Course (EFC): Spanish is the teaching-medium.

By the end of the course the student will be able to:
describe information extraction fundamentals and its potential scope on information systems.
apply data mining approaches to particular tasks related to knowledge discovery, business intelligence and decision support systems.

COMPETENCIAS DE LA ASIGNATURA: A continuación se enumeran las competencias de la asignatura y para cada una de ellas se establecen asociaciones con las competencias del módulo al que pertenece esta asignatura y también con las competencias transversales del catálogo de la UPV/EHU (posteriormente se describen tanto las competencias de módulo como las transversales)
CA1: Reconocer los beneficios del uso sistemático de técnicas de extracción de conocimiento para la obtención de modelos y patrones predictivos o descriptivos. Competencias asociadas: M03CM02, M03CM04, CT8
CA2: Conocer las distintas técnicas de aprendizaje automático y estadísticas utilizadas en minería de datos, su potencial, su coste computacional y sus limitaciones de representación y de inteligibilidad. Competencias alineadas: M03CM01, M03CM05, CT3
CA3: Elegir, para un problema concreto, qué técnicas de minería de datos son más apropiadas. Competencias asociadas: M03CM03, M03CM06, CT8
CA4: Generar los modelos y patrones elegidos utilizando una herramienta o paquete de minería de datos. Competencias asociadas: M03CM05, CT3
CA5: Evaluar la calidad de un modelo, utilizando técnicas sencillas de evaluación. Competencias asociadas: M03CM05
CA6: Conocer la problemática especial de la minería sobre la web y las técnicas más usuales. Competencias asociadas: M03CM01, M03CM06, CT8

COMPETENCIAS ESPECÍFICAS del MÓDULO M03: Sistemas de Información:
M03CM01 - Capacidad para integrar soluciones de tecnologías de la información y comunicaciones y procesos empresariales para satisfacer las necesidades de información de las organizaciones de las organizaciones, permitiéndoles alcanzar sus objetivos de forma efectiva y eficiente, dándoles así ventajas competitivas
M03CM02 - Capacidad para determinar los requisitos de los sistemas de información y comunicación de una organización atendiendo a aspectos de seguridad y cumplimiento de la normativa y la legislación vigente.
M03CM03 - Capacidad para participar activamente en la especificación, diseño, implementación y mantenimiento de los sistemas de información y comunicación.
M03CM04 - Capacidad para comprender y aplicar los principios y prácticas de las organizaciones, de forma que puedan ejercer como enlace entre las comunidades técnica y de gestión de una organización y participar activamente en la formación de los usuarios.
M03CM05 - Capacidad para comprender y aplicar los principios de la evaluación de riesgos y aplicarlos correctamente en la elaboración y ejecución de planes de actuación.
M03CM06 - Capacidad para comprender y aplicar los principios y las técnicas de gestión de la calidad y de la innovación tecnológica en las organizaciones.

COMPETENCIAS TRANSVERSALES:
Competencias transversales que reúne el "Catálogo de Competencias Transversales de la UPV/EHU" (https://www.ehu.eus/es/web/enplegua/competencias-transversales) referenciadas, debajo, siguiendo la notación del catálogo referido. Concretamente:
CT3 Comunicación y Plurilingüismo. Saber comunicar y transmitir conocimientos, habilidades y destrezas correspondientes a un graduado en Ingeniería Informática de Gestión y Sistemas de Información.
CT8 Trabajo en Equipo. Acciones colaborativas y fomento de co-responsabilidad.

RESULTADOS DE APRENDIZAJE:
R1: Identificar fuentes de incertidumbre inherentes a los problemas de extracción de conocimiento en los contextos de Business Intelligence, analizar cuantitativamente datos disponibles y proponer soluciones adaptadas al marco de aplicación. Competencias alineadas: CA2, CA3, CA4, CA5, M03CM01, M03CM04.
R2: Diseño, implementación, documentación de sistemas de inferencia en entornos de aplicación reales en entornos de trabajo en grupo de forma eficaz. Competencias alineadas: CA1, CA2, CA3, CA6, M03CM03, M03CM02, CT8
RA3: Análisis de sensibilidad a la vista de resultados experimentales en la toma de decisiones con riesgo para esOmar el potencial de un sistema de minería de datos así como la comunicación de los resultados técnicos tanto de forma escrita como oral. Competencias alineadas: CA1, CA4, CA5, CA6, M03CM06, M03CM05, CT3

Theoretical and Practical Contents

* OBSERVE: THIS COURSE IS SET AS AN English Friendly Course (EFC): Spanish is the teaching-medium.

Introduction to Data Mining: Goal. Applications. Approaches: Classification, Association, Clustering. Data and data-sources. Pre-processing. Feature selection. Data imbalance.

Clustering: Signal compression. Approaches: k-means, hierarchical, agglomerative. Applications (e.g. homes, species, customer trends).

Predictive models: Inference algorithms: neural networks, bayesian networks, random forest, logistic regression etc. Evaluation metrics (e.g. confusion matrix, precision, recall, f-score, AUC). Ensemble models. Multi-class mono-label vs. multi-class multi-label prediction models. Real tasks and international research challenges. Applications: clinical diagnoses.

INTRODUCCIÓN:
· Objetivo. Contexto de aplicación.
· Aplicaciones comerciales: propensión/scoring, retención, venta cruzada, sistemas web, pronóstico y diagnóstico médico, aplicaciones industriales, procesamiento del lenguaje natural.
· Inteligencia artificial. Aprendizaje automático. Reconocimiento de formas.
· Aproximaciones a la minería de datos: Clasificación, Asociación, Clustering
· Datos: Recopilación de datos. Análisis.
· Pre-procesamiento: Selección de atributos. Introducción a los heurísticos de búsqueda y los algoritmos genéticos. Des-balance o cómo aprender con pocos datos.

TÉCNICAS EXPLORATORIAS: CLUSTERING
· Clasificación no-supervisada (clustering)
· Estudio de técnicas de clustering: clustering particional (k-means clustering); clustering probabilístico (algoritmo EM); clustering jerárquico (algoritmo aglomerativo); redes neuronales.
· Aplicaciones: Compresión de señal y teoría de la información; tendencias de clientes; detección de especies; mapa socio-lingüístico; web mining en artículos.

TÉCNICAS PREDICTIVAS: CLASIFICACIÓN
· Técnicas de evaluación y validación de clasificación supervisada
· Algoritmos de inferencia: neural networks, bayesian networks, random forest, logistic regression · Combinación de clasificadores: meta-clasificadores (ensembles)
· Modelos multi-class mono-label vs. multi-class multi-label
· Aplicaciones: business intelligence, diagnóstico clínico

TEACHING METHODS

* OBSERVE: THIS COURSE IS SET AS AN English Friendly Course (EFC): Spanish is the teaching-medium.

The approach is mainly practical, the classes are taken in the lab. Programming labs are carried out and presented in groups. By the end of the course a research-style poster is presented covering a related article or a self-implemented application.

La asignatura es presencial.

La asignatura se desarrolla mediante tres tipos principales de actividades: clases magistrales de teoría, sesiones prácticas de ordenador y de trabajo y discusión. Todas las actividades requiren actitud pro-activa y pensamiento crítico. Se fomentan metodologías activas de enseñanza-aprendizaje.

Grupo de Ordenador: tienen como objetivo implementar en sistemas reales las técnicas trabajadas en las clases magistrales. Para adquirir diversas capacidades se fomenta el trabajo en equipo cooperativo y también se asume trabajo autónomo.

TYPES OF TEACHING

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

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 40%
- Exercises, cases or problem sets 60%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Assessment parts and weighting: over 10.0 pts
60% (~ 6.0 pts): Labs and works carried out throughout the course
40% (~ 4.0 pts): Exam

Two requirements must be satisfied:
1. Achieve, at least, 40% on both parts i.e. minimum 2.4 points at labs and 1.6 points at the exam.
2. Summing up both parts together, achieve, at least, 5.0 points out of 10.0.

In order to evaluate the labs: in the ordinary call continuous assessment is carried out. In the remaining calls (either extraordinary call or calls taken in advance) a lab-exam is taken in replacement of the continuous assessment.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Assessment parts and weighting: over 10.0 pts
60% (~ 6.0 pts): Labs and works carried out throughout the course
40% (~ 4.0 pts): Exam

Two requirements must be satisfied:
1. Achieve, at least, 40% on both parts i.e. minimum 2.4 points at labs and 1.6 points at the exam.
2. Summing up both parts together, achieve, at least, 5.0 points out of 10.0.

In order to evaluate the labs: in the ordinary call continuous assessment is carried out. In the remaining calls (either extraordinary call or calls taken in advance) a lab-exam is taken in replacement of the continuous assessment.

MANDATORY MATERIALS

eGela

BIBLIOGRAPHY

Basic bibliography

· E. Alpaydin. Introduction to Machine Learning. MIT Press, 2009
· Ian Witten, Eibe Frank, Mark A. Hall. Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann, 2006
· Murphy, K.P. (2012). Machine learning: a probabilistic perspective. MIT press. · Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. 2016

Detailed bibliography

· C.M. Bishop; Pattern Recognition and Machine Learning. Springer. (2006).
· Richard O. Duda, Peter E. Hart, David G. Stork; Pattern Classification; Ed. Wiley-Interscience; 2 ed ISBN-13: 978-0471056690
· S. Chakrabarti. Mining the Web: Discovering knowledge from hypertext. Morgan Kaufmann. 2003
· Jiawei Han & Micheline Kamber. Data Mining: Concepts and Techniques. Morgan Kaufmann, 2006
· Pang-Ning Tan, Michael Steinbach & Vipin Kumar. Introduction to Data Mining. Addison-Wesley, 2006 · Tom Mitchell. Machine Learning. McGraw Hill, 1997.

Journals

ACM Transactions on KDD
IEEE Transactions on Knowledge and Data Engineering
Data Mining and Knowledge Discovery (DMKD)
ACM SIGKDD Explorations
Data & Knowledge Engineering (DKE)

Web sites of interest

http://www.cs.waikato.ac.nz/ml/weka/
http://kaggle.com/
http://www.kdd.org/
http://www.kdnuggets.com/
http://www-stat.stanford.edu/%7Ejhf/ftp/dm-stat.pdf

OBSERVATIONS

ENGLISH FRIENDLY COURSE (EFC):
Spanish is the teaching-medium.
Both the lectures and the main teaching-material are in Spanish.
However, student-interventions in English are welcome in class.
The lecturers are willing to tutor, conduct examinations and/or accept results, works and e-mails in English.
The course aims at international students with either a good command of Spanish or a medium level of Spanish and good command of English.

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GIIGSI30 - Bachelor's Degree in Computer Engineering in Management and In **Year** Fourth year

COURSE

27712 - Advanced Software Design **Credits, ECTS:** 6

COURSE DESCRIPTION

Most of the software design and development techniques seen in the first three years of the degree are applied to build desktop or web applications. In this module, students will learn to design and develop mobile applications, by translating the skills they already have into a new framework: the Android development environment.

In order to take this module, students should previously know:
- Object-oriented programming using Java or a similar programming language
- Relational database design and SQL
- Working in groups

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

On completion of the module a student should be able to:
- Understand the importance of design as a part of the software development process
- Understand and use third-party software libraries
- Acknowledge, understand and use software design patterns correctly as part of the software development process
- Understand and develop web-service oriented architectures
- Understand the fundamentals of mobile application development

Theoretical and Practical Contents

This module is arranged in the following topics:

1. Fundamentals of Android
2. User interfaces: layouts and fragments
3. Notifications and dialogs
4. Local storage: files and databases
5. Services and broadcast messages
6. Background work
7. Third party libraries
8. Google Play Services
9. Remote databases
10. Push notifications with Firebase
11. Cross platform frameworks

Due to the changing nature of the mobile-application development ecosystem, some of these topics might change slightly or get updated over the course of the module.

TEACHING METHODS

Theory and practice sessions.

TYPES OF TEACHING

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

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

- Individual assignments 60%

- Teamwork assignments (problem solving, Project design) 40%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Students can choose between two methods of assessment: continuous and final.

Students who choose continuous assessment will get their grade based on three tasks:
- 2 individual projects, each project corresponds to 30% of the final grade. Practical projects consist of the implementation a mobile application that meets certain requirements.
- Group project, 40% of the final grade. Development of a project in a group of 2 or 3 students. Students can choose to use several tool/technique presented in the module.

Students who choose final assessment will get their grade based on a single practical exam at the end of the module.

For more information about the assessment method, get in touch with the teaching staff.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

For more information about the assessment method, get in touch with the teaching staff.

MANDATORY MATERIALS

All the necessary material will be available at the university's eGela platform.

BIBLIOGRAPHY

Basic bibliography

Android Developer website: https://developer.android.com/

Learn Android Studio 4 : efficient Java-based Android apps development
Ted Hagos (Author); Electronic book 2020 2nd ed.
Berkeley, CA : Apress, 2020.

Detailed bibliography

Flutter: https://flutter.dev/
Android sub-forums at Medium: https://medium.com/androiddevelopers
Youtube channel, Android developers, run by Google: https://www.youtube.com/user/androiddevelopers/

Journals

Web sites of interest

Android Developer website: https://developer.android.com/
Flutter: https://flutter.dev/
Medium forum: https://medium.com/androiddevelopers
Youtube: https://www.youtube.com/user/androiddevelopers/

OBSERVATIONS

Universidad del País Vasco Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 364 - Faculty of Engineering - Bilbao **Cycle** .

Degree GCIVIL30 - Bachelor`s Degree in Civil Engineering **Year** Fourth year

COURSE

26595 - Environmental Engineering **Credits, ECTS:** 6

COURSE DESCRIPTION

The main aim of the course is to provide the student with a background knowledge in environmental pollution from an engineering point of view. The course is focused on pollution sources, remediation and treatment technologies, environmental impact assessment, environmental management and environmental regulation. Students are introduced to the mechanisms of environmental pollution and treatment methodologies, as well as to the evaluation and remediation of the environmental impact caused.
"Environmental Engineering" is taught during the first semester of the fourth year of the Degree. It requires prior knowledge and skills acquired in previous basic and specific courses, in particular in "Environmental Science and Technology". It is a compulsory course.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The competences acquired in the course will allow students to:
- Apply methodologies in order to perform environmental impact assessment studies.
- Apply environmental technologies, sustainable solutions, and pollution remediation technologies in different environmental media (air, water, waste, and soils).

Theoretical and Practical Contents

The theoretical and practical contents comprise six modules and eleven topics:
Module I. Fundamentals of environmental engineering.
Topic 1. Environmental engineering. Environmental pollution and sustainability. Environmental chemistry: Units of concentration, equilibrium processes, material and energy balances.
Module II. Water
Topic 2. Water pollution. Water uses and demands. Water pollution. Quality indicators. Regulation
Topic. 3. Urban and industrial wastewater treatment technologies. Wastewater characterization: urban and industrial wastewater. Municipal and industrial wastewater treatment plants. Water and sludge lines. Municipal wastewater treatments: pretreatment, primary, secondary, and advanced treatments. Industrial wastewater treatments. Sludge treatments. Treated wastewater reuse.
Module III. Air
Topic 4. Atmospheric Pollution. Introduction to air pollution: concepts, scales, structure and composition of the atmosphere. Energy balance. Main atmospheric pollutants: sulfur, nitrogen, carbon, and halogenated compounds. Pollutants' sources and adverse effects. Dispersion of air pollutants. Atmospheric stability. Air quality and regulation. Noise pollution.
Topic 5. Industrial emission control and reduction technologies. Characterization and reduction of industrial emissions. Equipment: cyclones, baghouses, electrostatic precipitators, scrubbers.
Module IV. Waste
Topic 6. Waste management and characterization. Waste types and regulation. The European Waste Catalogue. Municipal waste characterization and management. Industrial waste. Hazardous wastes.
Topic 7. Waste treatment technologies. Municipal waste treatment: biological treatment (composting), thermal treatments (incineration, pyrolysis, gasification), and landfills. Industrial waste treatment. Hazardous waste treatment. Construction and demolition waste.
Module V. Soil
Topic 8. Soil pollution. Context. Soil characterization. Soil pollutants: heavy metals, acid rain, salinization, phytosanitary products (insecticides, herbicides, fungicides), mining activity, organic products (pesticides). Regulation.
Topic 9. Recovery of polluted soils. Containment techniques: barriers and sealing. Confinement techniques: physical-chemical stabilization, injection of solidifiers, vitrification. Decontamination techniques: physical-chemical, biological, thermal, and mixed treatments.
Module VI. Environmental Management
Topic 10. Environmental Impact Assessment. Basic concepts. Environmental Impact Assessment. Regulation.
Topic 11. Environmental Management Systems and Environmental Audits. Sustainable development. ISO 14001 standard and EMAS regulation. Environmental Audits.

Practice in the field include three visits to industrial facilities:
Session 1: 1.1.- Wastewater treatment plant (Güenes), 1.2.- Construction and demolition waste valorization plant (Harrigreen).
Session 2: 2.1. Municipal waste thermal valorization plant (Zabalgarbi). 2.2. Mechanical and biological treatment plant (TMB)

Session 3: 3.1. Environmental classroom and leachate treatment plant of a urban waste landfill (Artigas). 3.2. Composting plant (Bizkaiko Konpostegia)

TEACHING METHODS

The course will be delivered by means of:
- Lectures (MC), which will be used to explain core contents in order to develop students' knowledge and understanding of these concepts.
- Classroom practices (CP), which will be used to solve practical activities, problems, etc.
- Practice in the field (FP), which will be used to visit industrial facilities.

If the health situation avoids the development of any teaching or evaluation activity, a non-presential alternative will be used and the students will be promptly informed.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	37,5		12,5						10
Horas de Actividad No Presencial del Alumno/a	56,25		18,75						15

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

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 56%
- Multiple choice test 24%
- Exercises, cases or problem sets 12%
- Field practices 8%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

CONTINUOUS ASSESSMENT is used in both ordinary and extraordinary sessions.

Written exams comprising theory and problems (multiple choice test, theoretical questions and exercises)
- Three mid-term exams (eliminatory for students with a minimum grade of 5.0/10 and passing at least two or more mid-term exams).
- A final exam, if the student does not pass two or more mid-term exams: 80 % (mid-term exam of one part, with its corresponding grade).
- Practical face-to-face activities: 12 %
- Practice in the field: 8 %

Notes:
Students will withdraw from the ordinary session by default if they do not take the ordinary final exam.
Any student wishing to waive continuous evaluation and wishing to be marked by FINAL ASSESSMENT instead by continuous assessment in the ordinary session should request this in a written document from the lecturer responsible for the course before the ninth week after the course starts.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

There are two options:
1) CONTINUOUS ASSESSMENT. This is the default option; students are assessed by means of:
- Final exam: 80%
- Practical activities: 12%
- Practice in the field: 8%
2) FINAL ASSESSMENT, for any student wishing to waive continuous evaluation (see section 6.2). Students are required to take a single exam (100% of the mark), comprising all the concepts and skills covered throughout the course.

MANDATORY MATERIALS

Materials required to follow the sessions will be shared with the students though eGela virtual platform:

- Lecture materials and documents,
- Problems' wordings and instructions for practical activities.
- Links to useful websites and reports.

BIBLIOGRAPHY

Basic bibliography

This section contains a basic bibliography in English (resources in Spanish are included in the corresponding guide).

- Baird, C. (2005). Environmental chemistry (3rd ed.). W.H. Freeman.
- Kiely (1996) Environmental Engineering, McGraw-Hill College.
- Manahan, S. E. (2001). Fundamentals of environmental chemistry (2th ed.). Lewis. –
- Metcalf & Eddy (2003) Wastewater Engineering: Treatment and Reuse, McGraw-Hill Science Engineering.
- Tchobanouglous (1993) Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw-Hill Science Engineering.

Detailed bibliography

- Dullien, F.A.L. (1989). Introduction to Industrial Gas Cleaning. Academic Press.
- Kreith, F., Tchobanoglous, G., & Kreith, F. (2002). Handbook of solid waste management (2nd ed., Ser. Mcgraw-hill handbooks). McGraw-Hill.
- Seinfeld, J.H. (1986). Atmospheric Chemistry and Physics of Air Pollution. John Wiley & Sons.
- Seinfeld, J.H. y Pandis, S.N. (1998). Atmospheric Chemistry and Physics. From Air Pollution to Climate Change. John Wiley & Sons.
- Stern, A.C. (Editor) (1986). Air pollution. Academic Press.
- Tchobanoglous, G. and Kreith, F. (2002) Handbook of Solid Waste Management. McGraw-Hill.
- Tchobanoglous, G., Burton, F. L., Stensel, H. D., Burton, F. L., & Metcalf & Eddy. (2003). Wastewater engineering: treatment and reuse (4th ed. /, Ser. Mcgraw-hill series in civil and environmental engineering). McGraw-Hill.
- Vallero, D. (2008). Fundamentals of Air Pollution. Elsevier.
- Wallace, J.M., Peter V. H. (2006) Atmospheric Science. An Introductory Survey. Editorial Elsevier.
- Wentz, C.A. (1995). Hazardous Waste Management. McGraw-Hill.

Journals

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Web sites of interest

Basque Government. Department of the Environment, Territorial Planning and Housing. http://www.euskadi.eus/gobierno-vasco/departamento-medio-ambiente-politica-territorial/inicio/
Eur-lex. Access to the Official Journal http://europa.eu.int/eur-lex/
European Environment Agency (EEA) http://www.eea.eu.int
Ministry for Ecological Transition and Demographic Challenge - MITECO, Spanish Government https://www.miteco.gob.es/es/
Public Society for Environmental Management of the Basque Government – IHOBE http://www.ihobe.es
United States Environmental Protection Agency (EPA) http://www.epa.gov

OBSERVATIONS

Conditions and clarifications:
If the health situation avoids the development of any evaluation activity, a non-presential alternative will be used and the students will be promptly informed.
1.- Any student that passes the three mid-term exams will be exempt to take the final exam (average grade of 5.0/10), with the exception of those students who not pass practical activities and practice in the field or if the final grade is < 5,0.
2.- The mark obtained in practical activities and in practice in the field will be considered if the student:
- Passes all mid-term exams and he/she is exempt to take the final exam.
- Does not pass one of the mid-term exams, but the grade of the failed part is >=4,0.
- Does not pass the final exam, but her/his grade is >=4,0.
3.- The mark obtained in the practice in the field will be carried over for two academic years.
4.- Any student assumes to obey academic regulation and to take "Environmental Engineering" course with an ethical behaviour and honesty. Hence, plagiarizing exams or activities will be strongly penalized and may lead to fail the course.

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 364 - Faculty of Engineering - Bilbao **Cycle** .

Degree GCIVIL30 - Bachelor`s Degree in Civil Engineering **Year** Fourth year

COURSE

27783 - Acoustics and Noise Control in Civil Engineering **Credits, ECTS:** 4,5

COURSE DESCRIPTION

The subject gives a detailed introduction to the principles and practice of acoustics and presents the possible solutions to noise problems with special interest in construction related situations.

It is divided into three blocks: first, we establish the basic principles of acoustics and sound perception. In a second block, we introduce the absorption to study the optimal acoustic conditions of a given space (factories, theaters, restaurants, …), taking into account that the noise/sound and the receiver are in the same space. Finally, we deal with sound isolation, where the sound and the receiver occupy different spaces. We analyze the isolation from traffic, airports, machine vibrations, and in all kind of buildings.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

Competencies:
- At the end of the course the students should know and understand the basics of the subject.
- Show the capacity of solving specific situations related to acoustics.
- Be able to find and interpret the relevant data to give solutions to acoustics problems considering technical, economical and legal aspects.
- Be able to present (in writing and through oral presentations) their results in a well-structured manner.

Theoretical and Practical Contents

Syllabus:

1. Basic acoustic concepts: waves, measurement of sound intensity, harmonics, octaves, normal modes.
2. Sound perception: the effect of noise on the human being, volume, frequency, spectrum of hearing.
3. Indoor acoustic concepts: reflection, diffraction, absorption, reverberation.
4. Absorption in enclosed spaces. Methods of sound absorption and materials.
5. Soundproofing. Aerial noise, structural noise. Transmission loss. Mass law. Methods and materials.

Computer sessions:

1. Waves: normal modes in 1 and 2 dimensions, speed of sound in different media.
2. Noise map of the area surrounding our School: direct measurement using the QGIS program.
3. Noise map using noise prediction software, CadNa (Datakustik). Comparison with what we obtain through direct measurements.
4. Calculation of the soundproofing of different partitions using the software INSUL, where we can experiment with different thickness and materials.

TEACHING METHODS

This course has 45 hours of class. 2/3 of the hours correspond to theory classes while the rest is devoted to the computer sessions, where we work with software specifically designed to study acoustics and noise control. Besides, there are 6h/week of office hours, which can be held in English.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	30				15				
Horas de Actividad No Presencial del Alumno/a	45				22,5				

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

Evaluation methods

- Continuous evaluation

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 30%
- Multiple choice test 30%
- Exercises, cases or problem sets 20%
- Oral presentation of assigned tasks, Reading¿ 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

1st option:

60% of the mark is obtained from the tests done along the course.
20% from the work done in the computer sessions
20% from the presentation of a paper of something related to the subject.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

100% of the mark from an exam.

MANDATORY MATERIALS

BIBLIOGRAPHY

Basic bibliography

"Master Handbook of Acoustics", F. Alton Everest and Ken C. Pohlmann
"Industrial Noise Control and Acoustics", R. F. Barron
Notes and presentations found in http://egela.ehu.eus

Detailed bibliography

"Engineering Noise Control", D.A. Bies and C.H. Hansen
"Noise and Vibration Control Engineering" L.L. Beranek

Journals

“Acoustics in Practice”
“Applied acoustics”

Web sites of interest

https://phet.colorado.edu/en/simulations/category/physics/sound-and-waves
http://www.acs.psu.edu/drussell/demos.html
https://euracoustics.org/activities/acoustics-in-practice

OBSERVATIONS

Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2024/25

Faculty 364 - Faculty of Engineering - Bilbao **Cycle** .

Degree GCIVIL30 - Bachelor`s Degree in Civil Engineering **Year** Fourth year

COURSE

27786 - Geographic Information Systems **Credits, ECTS:** 4,5

COURSE DESCRIPTION

GEOGRAPHIC INFORMATION SYSTEMS is an optative subject of the Civil Engineering degree. The main objective of the subject is to introduce students to the field of Geographic Information Systems and to train them in the basic techniques of spatial analysis through the use of specific software.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The objective of this course is to teach students how to use Geographic Information Systems technology. The course has a practical nature and most of the teaching hours will be devoted to practical exercises where this technology will be used to perform exercises related to Civil Engineering and Urban Planning, Mining, Energy and Environment. These exercises will be carried out taking into account sustainability criteria.

The specific competences of the subject will be the knowledge about Geographic Information Systems as well as their application in studies and projects related to Civil Engineering.

The subject belongs to the module M05 of the degree and, therefore, it also has this module's own competence:

M05CM01. To complete, deepen and interrelate the disciplinary knowledge acquired in the training area.

The transversal competencies, on the other hand, will be to know how to communicate correctly and clearly the topics related to the subject, teamwork and the ability to solve the problems that arise in the resolution of exercises and projects by applying the knowledge acquired previously.

Transversal competences:

MEC1-That the students have demonstrated to possess and understand the knowledge of the subjects taught in the specialty module, based on their previous knowledge.
MEC2-Reasoned solution of specific problems of their specialty, integrating the knowledge acquired in the basic module as well as in the common module of the branch.
MEC3-Gather and interpret relevant data to enable him/her to propose justified solutions taking into account technical-scientific, legal and economic aspects.
MEC4 (verbal)-Transmit opinions and subject-specific topics verbally with confidence and fluency and in a structured manner.
MEC5-Integrate knowledge from different areas to propose adequate solutions in specific technical fields with autonomy (handling of standards, regulations, software, complex bibliography).

Theoretical and Practical Contents

1. Introduction to Geographic Information Systems.

2. Geographic Information Systems: definition, components, geographic information, historical evolution, applications.

3. Introduction to cartography: reference systems, scales, projections and thematic mapping.

4. Spatial analysis: definition, types of analysis using GIS. In this section will make use of multi-criteria techniques to identify possible solutions to typical civil engineering problems such as the best location for an infrastructure based on sustainability and efficiency criteria.

TEACHING METHODS

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	15				30				
Horas de Actividad No Presencial del Alumno/a	22,5				45				

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

- Exercises, cases or problem sets 50%
- Individual assignments 40%
- Oral presentation of assigned tasks, Reading¿ 10%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Due to the practical nature of the course, the evaluation will be carried out as follows:

- Realization of practices and exercises in the classroom (computer practices) proposed by the teaching staff where both the realization of the exercises and the attendance to class will be taken into account (E).
- Realization of an individual project whose nature will be defined with the teaching staff (P).
- Presentation and defense of the individual project (D).

The assesment of the subject will be made according to the following formula:
E Mark x 50% + P Mark x 40% + P Mark x 10%

Evaluation of transversal competencies:

-Computer practices (50%): MEC1
-Individual project (50%): MEC1, MEC2, MEC3, MEC4 (verbal), MEC5

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation in the extraordinary examination period will be carried out by means of a final exam where the student will have to take a test that proves the basic knowledge of the computer program used during the practical training as well as a basic knowledge of the theoretical contents.

MANDATORY MATERIALS

Class notes

BIBLIOGRAPHY

Basic bibliography

-BOSQUE SENDRA, J. Sistemas de información geográfica. Ediciones Rialp. Madrid, 1992
-GUTIÉRREZ PUEBLA, J. Y COULD, M.: SIG: Sistemas de información geográfica. Síntesis. Madrid., 1994
-MOLDES, F.J. Tecnología de los Sistemas de información geográfica. Ra-ma. Madrid. 1995
-MORENO JIMÉNEZ, A. (Coord): Sistemas y análisis de la información geográfica. Manual de autoaprendizaje con ArcGIS. Ra-Ma. Madrid. 2007
-PENA LLOPIS, J. Sistemas de información geográfica aplicados a la gestión del territorio. Club Universitario. Madrid. 2006
-SANTOS PRECIADO, J.M.: Sistemas de información geográfica. Ed. Universidad nacional de Educación a distancia. Madrid. 2004
-SANTOS PRECIADO, J.M.: El tratamiento informático de la información geográfica. Ed. Universidad nacional de Educación a distancia. Madrid. 2002
-BOSQUE SENDRA, J. Sistemas de información geográfica. Ediciones Rialp. Madrid, 1992
-GUTIÉRREZ PUEBLA, J. Y COULD, M.: SIG: Sistemas de información geográfica. Síntesis. Madrid., 1994
-MOLDES, F.J. Tecnología de los Sistemas de información geográfica. Ra-ma. Madrid. 1995
-MORENO JIMÉNEZ, A. (Coord): Sistemas y análisis de la información geográfica. Manual de autoaprendizaje con ArcGIS. Ra-Ma. Madrid. 2007
-PENA LLOPIS, J. Sistemas de información geográfica aplicados a la gestión del territorio. Club Universitario. Madrid. 2006

-SANTOS PRECIADO, J.M.: Sistemas de información geográfica. Ed. Universidad nacional de Educación a distancia. Madrid. 2004
-SANTOS PRECIADO, J.M.: El tratamiento informático de la información geográfica. Ed. Universidad nacional de Educación a distancia. Madrid. 2002

Detailed bibliography

-FORESMAN, T.M.: ¿GIS early years and de Threads of Evolution¿, en History of Geographic Information Systems: perspectives from Pioneers. Prentice Hall, London, 1998
-HEYWOOD, I., CORNELIUS, S. Y CARVER, S. (2006): An introduction to Geographical information systems. Pearson. Essex.
-KENNEDY, M. (2006): Introducing Geographic Information Systems with ArcGIS. Wiley.
-LONGLEY, P. et al. (2001): Geographic information system and science. Wiley.
-TOMLINSON, R. (2003): Thinking about GIS. Esri Press. California.

Journals

-Fórum Geográfico
-Geo Informatics
-Geo Focus
-Mapping Interactivo
-GIS Development Magazine
-GISMAP Magazine

Web sites of interest

-www.nosolosig.com
-www.unigis.es
-www.gis.com
-www.gislounge.com
-www.freegis.org
-www.cartesia.com
-www.gisportal.com
-www.geoplace.com
-www.opengis.com
-www.nosolosig.com
-www.unigis.es
- www.gis.com
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- www.freegis.org
- www.cartesia.com
- www.gisportal.com
- www.geoplace.com
- www.opengis.com

OBSERVATIONS