Universidad del País Vasco Euskal Herriko Unibertsitatea

# ENGLISH FRIENDLY COURSES (EFC) 2022-2023 – CAMPUS OF BIZKAIA

## MASTER COURSES FACULTY OF SCIENCE AND TECHNOLOGY (310)

https://www.ehu.eus/es/web/zientzia-teknologia-fakultatea/home
**Coordinator**: ciencia.internacional@ehu.eus

| | Master´s Degree in Chemical Engineering | SEMESTER | CREDITS | SCHEDULE[1] | LINK TO SYLLABUS |
|---|---|---|---|---|---|
| 504254 | Optimización Avanzada de Procesos Químicos | Sep. 2022 - Jan. 2023 | 4,5 | A | |
| 504255 | Modelado y Simulación de Procesos Químicos | Sep. 2022 - Jan. 2023 | 6 | A | |
| 504265 | Tecnologías de Refinería y Petroquímica | Jan. 2023 - May 2023 | 3 | A | |
| 504267 | Tecnologías catalíticas para el control de la contaminación del aire | Jan. 2023 - May 2023 | 3 | A | |
| | **Master´s Degree in Synthetic and Industrial Chemistry** | | | | |
| 504304 | Síntesis Química Avanzada | Sep. 2022 - Jan. 2023 | 3 | A | |
| 504305 | Metales en Síntesis | Sep. 2022 - Jan. 2023 | 3 | A | |
| 504306 | Síntesis Estereocontrolada | Sep. 2022 - Jan. 2023 | 3 | A | |
| 504309 | Química Orgánica Avanzada | Sep. 2022 - Jan. 2023 | 3 | A | |
| 504312 | Productos Naturales. Síntesis, biosíntesis y aplicaciones | Jan. 2023 - May 2023 | 3 | A | |

[1] SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30

Universidad del País Vasco Euskal Herriko Unibertsitatea

# ENGLISH FRIENDLY COURSES (EFC) 2022-2023 – CAMPUS OF BIZKAIA

## MASTER COURSES FACULTY OF ECONOMICS AND BUSINESS (321)

https://www.ehu.eus/en/web/ekonomia-enpresa-fakultatea/hasiera
**Coordinator**: economicas.internacional@ehu.es

| | **Master in Business Management from an Innovation and Internationalization Perspective** | **SEMESTER** | **CREDITS** | **SCHEDULE[2]** | **LINK TO SYLLABUS** |
|---|---|---|---|---|---|
| 502122 | Globalización y Gestión Financiera | Sep. 2022- Jan. 2023 | 3 | A | |
| 502109 | Marketing Ecológico: Estrategias y Técnicas de Investigación para un desarrollo sostenible | Jan. 2023- May 2023 | 3 | A | |
| 502110 | Comportamiento del consumidor y dirección de marca | Jan. 2023- May 2023 | 3 | A | |
| 502120 | Gobierno y control de la empresa familiar | Jan. 2023- May 2023 | 3 | A | |
| | **Master´s degree in Economics: Empirical Applications and Policies** | | | | |
| 503485 | Econometría | Sep. 2022- Jan. 2023 | 4 | M | |
| 503486 | Técnicas de inferencia estadística | Sep. 2022- Jan. 2023 | 3 | A | |
| 503487 | Análisis básico de series temporales | Sep. 2022- Jan. 2023 | 3 | A | |
| 503501 | Economía ambiental | Sep. 2022- Jan. 2023 | 3 | M | |
| 503506 | Teoría de Juegos | Sep. 2022- Jan. 2023 | 3 | M | |
| 503488 | Temas de Estadística y Series Temporales | Jan. 2023- May 2023 | 6 | M | |
| 503504 | Economía Recursos Naturales y Política Ambiental | Jan. 2023- May 2023 | 6 | M & A | |

[2] SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30

Universidad del País Vasco Euskal Herriko Unibertsitatea

# ENGLISH FRIENDLY COURSES (EFC) 2022-2023 – CAMPUS OF BIZKAIA

## MASTER COURSES FACULTY OF ENGINEERING – BILBAO (345)

https://www.ehu.eus/en/web/bilboko-ingeniaritza-eskola/hasiera
**Coordinator**: ingenieria.internacional@ehu.eus

| | Master's Degree in Telecommunications Engineering | SEMESTER | CREDITS | SCHEDULE[3] | LINK TO SYLLABUS |
|---|---|---|---|---|---|
| 504005 | Sistemas electrónicos de comunicaciones | Annual | 9 | M | |
| 504006 | Diseño y gestión de redes y servicios de telecomunicación | Annual | 9 | M | |
| 504007 | Microelectrónica | Sep. 2022- Jan. 2023 | 4,5 | M | |
| 504010 | Convergencia e Integración de Redes de Acceso y Troncales | Sep. 2022- Jan. 2023 | 4,5 | M | |
| 504011 | Tratamiento Avanzado de Señal | Sep. 2022- Jan. 2023 | 6 | A | |
| 504022 | Gestión y Metodología en Investigación | Sep. 2022- Jan. 2023 | 3 | M | |
| 504023 | Seguridad y Sistemas Distribuidos | Sep. 2022- Jan. 2023 | 4,5 | A | |
| 504026 | Tecnologías del Habla | Sep. 2022- Jan. 2023 | 4,5 | A | |
| 504027 | Procesado de señales biomédicas | Sep. 2022- Jan. 2023 | 4,5 | A | |
| 504014 | Laboratorio de circuitos digitales | Jan. 2023- May 2023 | 4,5 | M | |
| 504015 | Internet: Conceptos avanzados y nuevos servicios | Jan. 2023- May 2023 | 4,5 | M | |
| 504018 | Diseño avanzado de comunicaciones vía radio | Jan. 2023- May 2023 | 7,5 | M | |
| | **Master's Degree in Industrial Engineering** | | | | |
| 503302 | Diseño y Desarrollo de Producto | Sep. 2022- Jan. 2023 | 4,5 | A | |
| 503905 | Sistemas Integrados de Fabricación | Sep. 2022- Jan. 2023 | 3 | M | |
| 503915 | Dirección de Proyectos | Sep. 2022- Jan. 2023 | 6 | A | |
| 503924 | Laboratorio de Diseño de Producto | Sep. 2022- Jan. 2023 | 4,5 | A | |
| 503955 | Integración de Sistemas Industriales | Sep. 2022- Jan. 2023 | 4,5 | A | |
| 503956 | Automatización y Robótica | Sep. 2022- Jan. 2023 | 6 | A | |

[3] SCHEDULE: Morning (M)/ Afternoon (A): begins at 13.30.

Universidad del País Vasco Euskal Herriko Unibertsitatea

## Master's Degree in Industrial Engineering

| | | | | | |
|---|---|---|---|---|---|
| 503962 | Explotación y mantenimiento de Sistemas Hidráulicos | Sep. 2022- Jan. 2023 | 6 | A |  |
| 503922 | Diseño y Modelado Paramétrico | Jan. 2023- May 2023 | 4,5 | M |  |
| 503923 | Ciclo de Vida del Producto | Jan. 2023- May 2023 | 4,5 | M |  |
| 503959 | Gestión de Recursos Hidráulicos y centrales Hidroeléctricas | Jan. 2023- May 2023 | 6 | M |  |
| 503960 | Oleohidráulica | Jan. 2023- May 2023 | 3 | M |  |

| Master's Degree in Advanced Materials Engineering | | SEMESTER | CREDITS | SCHEDULE | |
|---|---|---|---|---|---|
| 503320 | Comportamiento mecánico de materiales | Sep. 2022- Jan. 2023 | 4,5 | A |  |

| Master's Degree in Space Science and Technology | | SEMESTER | CREDITS | SCHEDULE | |
|---|---|---|---|---|---|
| 501990 | Física Espacial | Sep. 2022- Jan. 2023 | 3 | A |  |
| 501991 | Fundamentos de Instrumentación Óptica | Sep. 2022- Jan. 2023 | 3 | A |  |
| 501994 | Materiales para el Espacio I: Fundamentos | Sep. 2022- Jan. 2023 | 3 | A |  |
| 502005 | Interferometría Espacial | Jan. 2023- May 2023 | 3 | A |  |
| 502006 | Astronomía y Astrofísica | Jan. 2023- May 2023 | 3 | A |  |
| 502007 | Física del Sistema Solar | Jan. 2023- May 2023 | 3 | A |  |

**COURSE GUIDE** 2022/23

**Faculty** 310 - Faculty of Science and Technology
**Cycle** Not Applicable

**Degree** INQUI901 - Chemical Engineering
**Year** Not Applicable

## COURSE

504254 - Advanced optimization of chemical processes
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

The chemical industry The chemical industry is undergoing huge changes worldwide, to the increased cost of energy, increasingly stringent environmental regulations, and global competition in product pricing and quality. One of the most important engineering tools for addressing these issues is optimization. Modifications in plant design and operating procedures have been implemented to reduce costs and meet constraints, with an emphasis on improving efficiency and increasing profitability.
The course focuses on three key aspects: Firstly on how to formulate optimization problems appropriately because many engineers and scientists find this phase of their decision-making process the most exasperating and difficult; secondly on modeling the optimization problem and thirdly on the analysis of optimization results.

To apply optimization effectively in the chemical industries, both the theory and practice of optimization must be understood, both of which are explained in this course. It is organized into four parts: linear programming, integer programming, nonlinear programming and design of experiments focused on plant optimization.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Apply knowledge of mathematics, physics, chemistry, biology, and other natural sciences, obtained through study, experience, and practice, with critical reasoning to establish economically viable solutions to technical problems
To design products, processes, systems and services for the chemical industry, as well as the optimization of others already developed, taking as a technological base the different areas of chemical engineering, including processes and transport phenomena, separation operations and chemical, nuclear, electrochemical and biochemical reaction engineering.
Conceptualize engineering models, apply innovative problem-solving methods and appropriate computer applications for the design, simulation, optimization and control of processes and systems.
Manage and supervise all types of installations, processes, systems and services in the different industrial areas related to chemical engineering.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Tras cursar la asignatura, el alumnado será capaz de:
- Identificar un problema de optimización en el ámbito de la ingeniería química.
- Definir un problema de optimización (lineal, entera o no-lineal).
- Seleccionar el método de optimización apropiado para la resolución de cada problema.
- Implementar el método de optimización y resolver el problema utilizando un software de cálculo apropiado.
- Analizar el resultado de un problema de optimización

## CONTENIDOS TEÓRICO-PRÁCTICOS

INTRODUCTION: Formulation of a optimization problema; types of problems; Review of basic techniques.
LINEAR PROGRAMMING: Problem definition. Simplex Algorithm. Examples and applications in Chemical Engineering.
NON-LINEAR PROGRAMMING: Problem definition. Nelder and Mead algorithm. Gradient based methods. Examples of regression application. Applications to Chemical Engineering.
INTEGER PROGRAMMING: Problem definition. Branching and dimensioning method. Dynamic programming. Practical examples.
DESIGN OR EXPERIMENTS: Design of optimization experiments. Advantages of experimental design. Minimum squares for linear models. Introduction to EVOP techniques. Examples.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Presentation and defence of projects | 5 | 100 % |
| Exercises | 10 | 20 % |
| Expositive classes | 15 | 100 % |
| Handling sources and resources | 17,5 | 0 % |
| Groupwork | 30 | 30 % |
| Case analysis | 35 | 40 % |

## TYPES OF TEACHING

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

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 0 % | 50 % |
| Presentations | 30 % | 60 % |
| Practical tasks | 40 % | 70 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The assessment is continuous based on works made throughout the term. These works will be graded attending to criteria of originality, degree of difficulty, appropriateness, coherence, resolution, and presentation. At the end, students will take an individual test.

Students can resign the ordinary call until one month before classes are over. In this case, the student must send a written resignation to any of the teachers in charge for the subject.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary assessment call, students will have take and exam and submit and present a individual work on optimization.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

Edgar, T.F., Himmelblau, E., Optimization of Chemical Processes, McGraw-Hill, 1988.
Box, G.E.P., Hunter, W.G., Hunter, J.S., Estadística para Investigadores, Reverté, Barcelona, 1988.

Box, G.E.P., Hunter, W.G., Hunter, J.S., Estadística para Investigadores, Reverté, Barcelona, 1988.

### Detailed bibliography

Douglas, J.M., Conceptual Design of Chemical Processes, McGraw-Hill, Chem. Eng. Series, 1988.
Puigjaner, L.,Ollero, P., Prada, C., Jiménez, L., Estrategias de Modelado, Simulación y Optimización de Procesos Químicos, Ed. Síntesis, 2006.
Taguchi, G., Introductiont to Quality Engineering. Designing Quality into Products and Proceses, Quality Resources, 1990

### Journals

Industrial & Engineering Chemistry Research
Chemical Engineering Science
Chemical Engineering Processing

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 310 - Faculty of Science and Technology
**Cycle** Not Applicable
**Degree** INQUI901 - Chemical Engineering
**Year** Not Applicable

## COURSE

504255 - Modelling and simulation of chemical processes
**Credits, ECTS:** 6

## COURSE DESCRIPTION

This subject is a core subject from the Chemical Engineering field and therefore it is mandatory, like in any other Chemical Engineering Master’s Degree in Spain or around the world. In order to take advantage of the course, it is necessary to have studied the basic subjects of Chemical Engineering. This includes subjects that deal with transport phenomena (Fluid Mechanics, Heat Transfer, and Mass Transfer), as well as those that deal with the design of chemical reactors (Kinetics of Chemical Processes and Reactor Design) and separation processes (Separation Processes). Moreover, it is recommended to have knowledge of the following subjects: Numerical Methods, Thermodynamics, Instrumentation and Control of Chemical Processes, and Programming. All of these subjects are included in the Chemical Engineering Bachelor Degree in addition to many other technical Bachelor Degrees. The knowledge and use of scientific programming languages such as Scilab and Matlab or that of process simulation in steady state (Pro II, ASPEN, HYSIS, or DWSIM) is desirable, but not imperative. The subject is closely related to all the contents from the Master’s that broaden the knowledge of the foundations of Chemical Engineering: Advanced Chemical Reactors, Advanced Process Control, Advanced Separation Processes, and Advanced Optimization of Chemical Processes.

Studying and passing this subject provides the student with the ability to approach the modelling and simulation of non-steady physic-chemical processes of industrial interest, using the calculus capacity of microprocessors to build tools that give way to address the effect of the design variables and those of operation conditions on the results of the process. The possibilities to actually apply the knowledge acquired in this subject in real professional practice are then unlimited.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Aplicar conocimientos de matemáticas, física, química, biología y otras ciencias naturales, obtenidos mediante estudio, experiencia, y práctica, con razonamiento crítico para establecer soluciones viables económicamente a problemas técnicos
Diseñar productos, procesos, sistemas y servicios de la industria química, así como la optimización de otros ya desarrollados, tomando como base tecnológica las diversas áreas de la ingeniería química, comprensivas de procesos y fenómenos de transporte, operaciones de separación e ingeniería de las reacciones químicas, nucleares, electroquímicas y bioquímicas
Conceptualizar modelos de ingeniería, aplicar métodos innovadores en la resolución de problemas y aplicaciones informáticas adecuadas, para el diseño, simulación, optimización y control de procesos y sistemas
Tener habilidad para solucionar problemas que son poco familiares, incompletamente definidos, y tienen especificaciones en competencia, considerando los posibles métodos de solución, incluidos los más innovadores, seleccionando el más apropiado, y poder corregir la puesta en práctica, evaluando las diferentes soluciones de diseño

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Tras cursar la asignatura, el alumnado será capaz de:
- Identificar los fenómenos fundamentales que controlan un proceso
- Desarrollar el modelado matemático
- Resolver las ecuaciones mediante herramientas de cálculo avanzadas
- Evaluar la adecuación del modelo desarrollado en base al análisis de los resultados
- Proponer y ejecutar la simulación de situaciones diversas y estudiar la respuesta del modelo

## CONTENIDOS TEÓRICO-PRÁCTICOS

Mass and Momentum balances in steady and non-steady state. Transfer in the interface. Microscopic Mass and Momentum balances in steady and non-steady state: equation of continuity. Velocity profiles.
Macroscopic Energy Balances in steady and non-steady state. Transfer in the interface.
Microscopic Energy Balances: temperature profiles in solid and fluid mediums.
Macroscopic and Microscopic Mass Balances in multicomponent systems. Concentration profiles with one or more independent variables. Transfer in the interface.
Macroscopic and Microscopic Mass Balances in multicomponent systems with chemical reactions. Inclusion of the kinetic model to the Mass balance. Concentration profiles with one or more independent variables. Numerical methods for the resulting equations of the modelling: multiple linear equations, multiple non-linear equations, ordinary differential equations, and partial differential equations.
Preparation of the developed model by computer software for evaluation and external use.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Presentation and defence of projects | 6 | 100 % |
| Expositive classes | 12 | 100 % |
| Handling sources and resources | 17 | 0 % |
| Groupwork | 30 | 40 % |
| Case analysis | 40 | 30 % |
| Exercises | 45 | 40 % |

## TYPES OF TEACHING

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

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 0 % | 40 % |
| Presentations | 20 % | 40 % |
| Practical tasks | 40 % | 80 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EVALUATION CRITERIA:

(1) Voluntary exercises: 30%
Theoretical exercises: In order to obtain the maximum grade a well-written and reasoned report, with a well-explained approach to the balances corresponding to the proposed system is required.
Practical exercises: In order to obtain the maximum grade the following are required: a checked algorithm that has been validated functionally. Moreover, a report must contain: 1) the approach to the balances corresponding to the proposed system, 2) the required mathematical development to obtain the system model, 3) a flow-chart of the algorithm that explains the resolution strategy, and 4) an analysis of the results obtained by simulation.
The maximum grade of this section is reached by properly carrying out 5 of the 8 proposed exercises.
(2) GUI Exercise: 20%
The evaluation of the GUI will be carried out by the following criteria:
Operability (0-10, weight: 5)
Number of elements (1 point/element, weight: 1)
Number of different elements (1 point/type of element, weight: 3)
Aesthetics (0-10, weight: 2)
Originality (0-10, weight: 2)

(3) Continuous assessment of the subject: 10%
Glossary: each original contribution will be valued at 1 point
Forum:
Question: 1 point
First answer: 2 points
Excellent answer: 3 points
All the points obtained in the glossary and the forum will be summed.
The student will have to obtain 40 points in order to reach the maximum grade of this section.
(4) Final Exam: 40%
The student will have to carry out a complete modelling and simulation of the process in question. All the material available in egela is allowed for its use in the exam.

FINAL MARK:

A minimum mark of 4/10 is required in each section that is evaluated.

WITHDRAWAL:

The student will have to give advance notice regarding his/her withdrawal from the ordinary call in writing, at least 24

hours before the exam. To do so, he/she will have to send an email to all of the lecturers of the subject in addition to the coordinator of the Master’s Degree.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EVALUATION CRITERIA:

The same ones as for the ordinary call.

WITHDRAWAL:

The student will have to give advance notice regarding his/her withdrawal from the ordinary call in writing, at least 24 hours before the exam. To do so, he/she will have to send an email to all of the lecturers of the subject in addition to the coordinator of the Master’s Degree.

## MANDATORY MATERIALS

Egela virtual classroom
Software: Scilab and Matlab

## BIBLIOGRAFÍA

### Basic bibliography

Ingham, J., Dunn, I.J., Heizle, E., Prenosil, J.E., Snape, J.B. Chemical Engineering Dynamics. An Introduction to Modelling and Computer Simulation. 3rd Ed. Wiley-VCH, 2007
Bird, R.B., Steward, W.E., Lightfoot, E. N., Transport phenomena, 2nd edition, Wiley (2005)

### Detailed bibliography

Ramírez, W.F., Computational Methods for Process Simulations, Butterworths, 1989.
Welty, J.R., C.E. Wicks, R.E. Wilson, and G. Rorrer, Fundamentals of Momentum, Heat, and Mass Transfer, 4th edition, Wiley (2000).
Constantinides, A., Mostoufi, N., Numerical Methods for Chemical Engineers with Matlab Applications, Prentice Hall (1999)
Marchand, P., Holland, O.T., Graphics and GUIs with Matlab, 3rd edition, Chapman & Hall/CRC (2003)

### Journals

www.sciencedirect.com/science/bookseries/15707946

### Web sites of interest

http://www.berkeleymadonna.com
www.mathworks.es/

**COURSE GUIDE** 2022/23

**Faculty** 310 - Faculty of Science and Technology

**Cycle** Not Applicable

**Degree** INQUI901 - Chemical Engineering

**Year** Not Applicable

## COURSE

504265 - Refinery and petrochemical technologies

**Credits, ECTS:** 3

## COURSE DESCRIPTION

In this course we study the refinery processes that allow obtaining fuels and chemicals(raw materials of the petrochemical industry and lubricants) from crude oil. Special emphasis is placed on the state of the art of current technology and the challenges in the medium and long term, based on two fundamental aspects: the quality of the products obtained and the environmental challenges of each stage. The course includes the visit to a industrial site and laboratory experiments.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Understand the current state of the standard technologies in industrial facilities of petroleum refining and petrochemical industries, pointing out the tendencies of processing of raw materials.
Manage bibliographic sources that allow access to scientific and technological advances, to international technology trends in the use raw materials. Studding data offered by specialized enterprises in the sector.
Knowing how to identify the best options among the technological proposals studied according to the context and the possibilities of each region.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Tras cursar la asignatura, el alumnado será capaz de:
- Identificar y describir las diferentes unidades existentes en la refinería y en la industria petroquímica, en base a las materias primas, productos, tecnologías, condiciones de operación y catalizadores.
- Caracterizar las principales propiedades del crudo y/o productos derivados (especialmente los combustibles y lubricantes).
- Investigar, a través de búsquedas en bases de datos, y comunicar de forma oral y/o escrita los avances tecnológicos de las diferentes unidades de la refinería y la industria petroquímica.
- Redactar informes técnicos sobre un proceso catalítico desarrollado en los laboratorios de investigación

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. Introduction: Socio-economic perspective of the oil supply and the petrochemical industry. Properties of crude oil. General scheme of a refinery

2. Fractionation of crude oil: atmospheric distillation unit. Vacuum unit. Future trends: Progressive distillation unit

3. Catalytic reforming, Isomerization, Alkylation and Oligomerization: Catalytic reforming. Isomerization. Alkylation. Oligomerization

4. Fluidized Catalytic Cracking: Feedstock and products. The reactor (riser-downer). The regenerator. Process variables and optimization. Challenges of the FCC

5. Hydrocracking and Hydrotreatment: Processes. Feedstock and products. The reactor Process variables and optimization. Challenges

6. Thermal Conversion: Coking. Visbreaking. Future trends

7. Petrochemical: Light olefins. Aromatics

8. Lubricants: Lubricants. Tribology

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Visit to industrial sites | 4 | 100 % |
| Groupwork | 8 | 50 % |
| Expositive classes | 18 | 100 % |
| Handling experimental equipment and facilities | 20 | 20 % |
| Handling sources and resources | 25 | 0 % |

## TYPES OF TEACHING

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

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 30 % | 70 % |
| Practical tasks | 30 % | 70 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The ordinary call consists of the evaluation of two parts, weighted in the following way:
- Written exam, 60% of the note
- Individual practical work, 40% of the mark

In case of renouncing the ordinary call, the assessment will be carried out in the following way:
Written exam, 100% of the grade, containing additional questions to assess the knowledge evaluated in the "Individual practical work "

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary exam consist of a written exam that accounts for 100% of the grade, containing additional questions to assess the knowledge evaluated in the "Individual practical work "

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

- Wauquier, J.P., El Refino del petróleo. Petróleo crudo, productos petrolíferos y esquemas de fabricación, Ed. Diaz de Santos, 2004
- Ramos Carpio, M. A., Refino del petróleo, gas natural y petroquímica; Ed. Fundación Fomento Innovación industrial, Madrid (1997).
- Leprince, P., Petroleum Refining. 3. Conversion Processes. Ed. Technip, 2001
- Matar, S. Hatch, L. F., Chemistry of Petrochemical Proceses, Elsevier, 2000
- Chauvel, A., Lefebvre, G., Petrochemical Processes. Technical and Economic Characteristics; Ed. Technip, Paris, 1989.

### Detailed bibliography

- Meyers, R.A., Handbook of Petroleum Refining Processes, Ed. McGraw-Hill, 2003
- Parkash S., Refining Processes Handbook, Elsevier, 2003
- Speight, J.G., Petroleum Refining Processes (Chemical Industries), Ed. Marcel Dekker, 2002

### Journals

Ind. Eng. Chem. Res., AIChE J., Energy and Fuels, Fuel, Fuel Proc. Technol., Chem. Eng. J., Energy Conv. Manage., Energy,...)

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 310 - Faculty of Science and Technology
**Cycle** Not Applicable

**Degree** QAPLI902 - Synthetic and Industrial Chemistry
**Year** Not Applicable

## COURSE

504304 - Advanced Chemical Synthesis
**Credits, ECTS:** 3

## COURSE DESCRIPTION

The course belongs to the common module of 12 ECTS of the Master involving compulsory courses and is taught during the first semester of the year. The four constituent courses of this module will provide students with essential advanced knowledge complementing that received in the Degree. This first semester is therefore basically theoretical and allows the students to complete their basic training and provides them with the basis for their Master's thesis.

The Advanced Chemical Synthesis is a course that is directly related to the compulsory subjects of the common module "Metals in Synthesis" and "Stereocontrolled Synthesis" of the first semester and to the optional subjects of the speciality modules "Advanced Organic Chemistry" of the first semester and "Design and Synthesis of Drugs" Synthesis in Solid Phase and Combinatorial Chemistry" taught in the second semester.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Planificar la síntesis de una molécula objetivo mediante el análisis retrosintético
Seleccionar y aplicar metodologías sintéticas eficientes a la síntesis de compuestos de interés
Identificar y discutir las etapas clave de una secuencia de síntesis,

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Unit 1. Introduction to Organic Synthesis. General principles. Efficiency and selectivity in synthesis. Methodology and strategies. Design of synthesis processes. Retrosynthetic analysis.

Unit 2. Electrophilic synthons. Nucleophilic synthons: stabilized and unstabilized carbanions. Disconnection of monofunctional systems. Disconnection of difunctional systems. Synthetic examples

Unit 3. Protective groups and auxiliary groups in organic synthesis. Practical examples.

Unit 4. Formation of C-C and C-heteroatom bonds.

Unit 5. Synthesis by pericyclic reactions: Synthetic examples of cycloaddition reactions, electrocyclic reactions and sigmatropic transpositions.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Reading and practical analysis | 4 | 100 % |
| Groupwork | 5 | 0 % |
| Handling sources and resources | 5 | 0 % |
| Expositive classes | 16 | 100 % |
| Text analysis | 20 | 0 % |
| Exercises | 25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 16 | 4 | 10 | | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 24 | 6 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 40 % | 70 % |

| | | |
|---|---|---|
| Practical tasks | 30 % | 60 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Due to the Coronavirus pandemic, this evaluation method could suffer changes if the guidelines of the sanitary authorities require it so. The necessary modifications would be announced timely.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Due to the Coronavirus pandemic, this evaluation method could suffer changes if the guidelines of the sanitary authorities require it so. The necessary modifications would be announced timely.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

-"Modern Methods of Organic Synthesis", W. Carruthers, I. Coldham, 4th Ed., Cambridge University Press, 2004.
-"Organic Synthesis" M. B. Smith, 4th Ed., Academic Press, 2016.
-"Organic Synthesis: The Disconnection Approach", S. Warren, Jonh Wiley and Sons, 1983.
-"Diseño de Síntesis Orgánica: Introducción Programada al Método del Sintón", S. Warren, Ed. Alhambra, Madrid, 1983.
-"Análisis Retrosintético y Síntesis Orgánica", M. Carda, J. A. Marco, J. Murga, E. Falomir, Publications de la Universitat Jaume I, 2010.
-"Green Chemistry, an Introductory Text", Lancaster, M., 2nd ed., RSC Publishing, 2010 -"Cycloaddition Reactions in Organic Synthesis", Wiley-UCH, 2002, S. Kobayashi, K.A. Jorgensen.
-"Protecting Groups", Thieme, 2004, P.J. Kocienski.
-"Greene`s Protective Groups in Organic Synthesis, Wiley-VCH, 2007, P.G.H. Wuts, T.W. Greene.

### Detailed bibliography

-"Advanced Organic Chemistry: Reactions, Mechanism and Structure", 5th Edition, J. March, M. B. Smith, J. Wiley, New York, 2001.
- "Organic Synthesis Highlights" Series, Varios, Wiley-VCH.

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 310 - Faculty of Science and Technology
**Cycle** Not Applicable

**Degree** QAPLI902 - Synthetic and Industrial Chemistry
**Year** Not Applicable

## COURSE

504305 - Metals in Synthesis
**Credits, ECTS:** 3

## COURSE DESCRIPTION

This course provides an initial knowledge on the structure, properties and methods of preparation of organometallic compounds to then advance towards the understanding of the roles of metals and organometallic compounds in Synthesis.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Comprender la estructura y propiedades de los principales tipos de compuestos organometálicos
Conocer y aplicar los métodos de síntesis de compuestos organometálicos
Comprender el papel de los metales y de los compuestos organometálicos en síntesis, aplicándolos a problemas sintéticos concretos

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

1- General Introduction to Organometallic Chemistry. Basic Concepts.
2- Organometallic compounds: Synthesis, structure and bonding. Relationship between nucleophilic character and structure.
3- Applications of organometallic compounds as reagents in Organic Synthesis.
4- Metal catalysts in Synthesis: structure, properties and applications.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Analysing and discussing papers | 8 | 100 % |
| Expositive classes | 12 | 100 % |
| Groupwork | 12 | 0 % |
| Text analysis | 18 | 0 % |
| Exercises | 25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 12 | 8 | 10 | | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 18 | 12 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 30 % | 80 % |
| Practical tasks | 20 % | 50 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXAMINATION GUIDELINES

- Written exam. Resolution of exercises and/or problems related to any aspect of the topics covered in the course. Weight in the final grade: 80%. Requirement: pass.

- Oral presentations. Discussion and presentation of literature examples based on articles from the recent literature, within the general subject of Organic Synthesis, where metal-mediated processes play a prominent role. Items to be graded will include the participation in the discussion and the quality of the personal work carried out (previous preparation, presentation, degree of understanding and answers to the questions). Weight in the final grade: 20%. Requirement: Participation (oral presentations and discussions).

- In the event that sanitary conditions prevent the performance of the evaluation in the terms described above, for all or part of the students enrolled in the course, the guidelines issued by the Rectorate on the evaluation at the time of carrying it will be followed.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

- Final written exam. Resolution of exercises and/or problems related to any aspect of the topics covered in the course. Weight in the final grade: 100%.

- In the event that sanitary conditions prevent the performance of the evaluation in the terms described above, for all or part of the students enrolled in the course, the guidelines issued by the Rectorate on the evaluation at the time of carrying it will be followed.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

(1) Crabtree, R. H. The Organometallic Chemistry of the Transition Metals; 6th ed.; Wiley, 2014.
(2) Yamamoto, Y. Organotransition Metal Chemistry: Fundamental Concepts and Applications; Wiley, 1986.
(3) Kegley, S. E.; Pinhas, A. R. Problems and Solutions in Organometallic Chemistry University Science Books 1986.
(4) Organometallics in Synthesis: A Manual; 3rd ed.; Schlosser, M., Ed. John Wiley & Sons: Chichester, 2013.
(5) Elschenbroich, C. Organometallics; 3rd ed; Wiley, 2006.

### Detailed bibliography

(6) Handbook of Organopalladium Chemistry for Organic Synthesis; Negishi, E., Ed. Wiley and Sons: New York, 2002.
(7) Metal-Catalyzed Cross-Coupling Reactions and More; de Meijere, A.; Bräse, S.; Oestreich, M., Eds.; Vol. 1-3; Wiley-VCH: Weinheim, 2014.
(8) Nicolaou, K . C. Et al. Classics in total Synthesis, Vol. I-III, VCH, 1996, 2003, 2011.
(9) Motherwell, W. B.; Crich, D. Free-radical chain reactions in organic synthesis; Academic Press, 1992.
(10) Radicals in Organic Synthesis; Renaud, P.; Sibi, M., Eds.; Wiley-VCH: Weinheim, 2001.

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 310 - Faculty of Science and Technology
**Cycle** Not Applicable
**Degree** QAPLI902 - Synthetic and Industrial Chemistry
**Year** Not Applicable

## COURSE

504312 - Natural Products: Synthesis, Biosynthesis and Applications
**Credits, ECTS:** 3

## COURSE DESCRIPTION

COMPETENCIES/LEARNING RESULTS
Understanding of the structures of the Secondary Metabolism Natural Products, and how they are produced and interconverted in nature (35%)
Ability to propose reasonable biosynthetic pathways for given natural products (25%)
Ability to apply the principles of synthetic design to the synthesis of relevant natural products (40%)

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocer y entender las estructuras de los Productos Naturales del metabolismo secundario y cómo se sintetizan y se interconvierten en los seres vivos

Proponer rutas biosintéticas razonables para productos naturales
Aplicar los principios del diseño de síntesis a la síntesis de Productos Naturales de interés

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

secondary metabolism. Elucidating biosynthetic pathways. .
Chapter 2.. The Acetate pathway (I). Fatty acids and derivatives.. Polyketides: de from tetraketides to decaketides. Tetracyclines. Macrocyclic antibiotics. Polyketides of marine origin..
Chapter 3. The Acetate pathway (II). Terpenes. From monoterpenes to tetraterpenes. MVA and MEP pathways. Cannabinoids. Natural fragances. Carotenoids. Chemistry of vision.
Chapter 4. The Shikimate pathway. Aromatic aminoacids and phenylpropanoids. Secondary metabolites from the shikimate pathway : lignanes and lignin. Coumarines, Flavonoids. Pharmacological properties.
Chapter 5. Alkaloids. Pyrrolidine, piperidine and tropane alkaloids. Tobaco alkaloids. Isoquinoline alkaloids. Opium alkaloids. Indole alkaloids. Phramacological properties.
Chapter 6. Peptides and othe aminoacid derivatives.Peptides. beta-lactam antibiotics. Penicillins and cephalosporins. Macrocyclic peptides.
Chapter 7. Total synthesis. Design and synthetic strategies towards natural product synthesis..
Chapter 8. Recent advances in natural product synthesis. Selected examples

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Expositive classes | 12 | 100 % |
| Text analysis | 18 | 0 % |
| Groupwork | 20 | 40 % |
| Exercises | 25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 12 | 8 | 10 | | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 18 | 12 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 30 % | 70 % |
| Practical tasks | 30 % | 70 % |

## ORDINARY EXAMINATION PERIOD:  GUIDELINES AND OPTING OUT

The final grade will be the result of the following parts:.

1. Written theory and practice exam: The exam will consist of theory and practice written exercises on the topics worked during the course. The appropriate approach to the exercises will be assessed, as well as the coherence and accuracy of the answers. The pass mark is 5/10.
2. Individual work. Set of exercises. Each student will be given a set of exercises that she/he will have to deliver at the end of the course. Bibliographic resources are allowed to solve these exercises. The appropriate approach to the exercises will be assessed, as well as the coherence and accuracy of the answers. The pass mark is 5/10.
Declining to sit implies not taking part in any of the above assessment parts.

This assessment system could be modified if required by the Sanitary authorities.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

1. Written theory and practice exam: The exam will consist of theory and practice written exercises on the topics worked during the course. The appropriate approach to the exercises will be assessed, as well as the coherence and accuracy of the answers. The pass mark  is 5/10.
2. Individual work. Set of exercises. Each student will be given a set of exercises that she/he will have to deliver at the end of the course. Bibliographic resources are allowed to solve these exercises. The appropriate approach to the exercises will be assessed, as well as the coherence and accuracy of the answers. The pass mark is 5/10.

This assessment systems could be modified if required by the Sanitary authorities.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

Dewick, P. M. "Medicinal Natural Products. A Biosynthetic Approach", 3ª ed.,Wiley, Chichester, 2009

### Detailed bibliography

Mann, J.; Davidson, R. S.; Hobbs, J. B.; Banthorpe, D. V.; Harborne, J. B. . "Natural Products. Their chemistry and biological significance", Addison Wesley Longman, Essex 1996
Marco, J.A., "Química de los Productos Naturales", Ed. Síntesis, Madrid, 2006
Nicolau, K. C.; Sorensen, E. J. "Classics in Total Synthesis. Targets, Strategies, Methods". WCH, Weinheim, 1996.
Nicolau, K. C.; Snyder, S. A "Classics in Total Synthesis II.". Wiley-WCH, Weinheim, 2003

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

| | | | |
|---|---|---|---|
| **Faculty** | 321 - Faculty of Economics and Business | **Cycle** | Not Applicable |
| **Degree** | DIREM401 - Master in Business Management From An Innovation and Interna | **Year** | Not Applicable |

**COURSE**

502120 - Family Business Governance and Control | **Credits, ECTS:** 3

**COURSE DESCRIPTION**

DESCRIPTION AND CONTEXTUALIZATION OF THE COURSE

Family firms account for two thirds of all businesses around the world, generate around 70-90 percent of annual global GDP, and create 50-80 percent of jobs in the majority of countries worldwide, playing a significant role in economic growth and territorial development. Common denominators of such firms include family involvement in the enterprise and a desire to maintain family control over the business in future generations.

The particular nature of such enterprises and the interaction between family and firm significantly influences ownership, governance and management, clearly marking them out from non-family businesses. These distinctive features add greater complexity to firms management and it is important to understand the relationships arising out of the relationship between family and firm and the particular elements they bring to governance and management.

Aims of the course

This course is oriented towards management of family businesses. Its main purpose is therefore to provide students with tools for understanding family firms’ behaviour. The course will examine specific features of family firms including setting objectives (economic and noneconomic), generational succession, governing bodies, relationships between firm and family and internal behavior. In addition, their relationships and their influence on entrepreneurship, innovation and the internationalization strategy, among other aspects, are also analyzed.

COMPETENCIES AND LEARNING OUTCOMES

The expected learning outcomes can be summarised as follows:

-Knowing and understanding the specific nature of the family business and the implications of such circumstances for governance and management.

-Understanding the challenges and dynamics of family firms throughout their lifecycles and their continuity over time.

-Identifying the strengths and weaknesses of family businesses, enabling the acquisition of skills for managing business and family systems.

-Understanding the concept of corporate governance in a broad sense, and its application in the context of the family firm.

-Identifying the governance structures of the family business and the business family, as well as the mechanisms for channelling the relationships between these structures.

-Being able to understand the influence of economic and non-economic aspects derived from the family nature in the strategic decision-making of the business, especially in relation to the entrepreneurship, the innovation and the internationalization of the family business.

-Developing management skills that promote growth and internationalisation of the family firm.

**COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT**

**COMPETENCIAS DE LA ASIGNATURA**

Conocer el peso de la empresa familiar en la economía
Conocer las características que diferencian a la empresa familiar de la no familiar
Ser capaz de identificar el control familiar en distintos estructuras empresariales: de propiedad concentrada y de propiedad dispersa
Comprender las relaciones de agencia en el seno de la empresa familiar
Identificar los conflictos de interés entre los distintos agentes vinculados a la empresa familiar
Ser capaz de comprender la influencia del altruismo en los costes de agencia

Comprender el concepto de gobierno corporativo en un sentido amplio, y la razón de la existencia de Códigos de Buen Gobierno
Ser capaz de trasladar el concepto de gobierno corporativo a la peculiaridad de la empresa familiar
Identificar las estructuras de gobierno de la empresa familiar y de la familia empresaria, así como los mecanismos para encauzar las relaciones entre dichas estructuras

## RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. FAMILY FIRM: CULTURE AND VALUES.

2. DESIGN OF GOVERNMENT STRUCTURES OF THE FAMILY FIRM.

3. TRANSGENERATIONAL CONTINUITY OF THE FAMILY FIRM.

4. INNOVATION, ENTREPRENEURSHIP, AND INTERNATIONALIZATION OF THE FAMILY FIRM.

5. UNIQUENESS IN THE FINANCIAL ASPECTS OF THE FAMILY FIRM.

The course contents is complemented with a series of seminars and conferences given by staff and executives from family businesses. This activity is organised by the Family Business Chair at the University of the Basque Country, in collaboration with the Provincial Government of Bizkaia, Bilbao Chamber of Commerce, CEBEK (the Businesses Confederation of Bizkaia) and AEFAME (Association of Family Firms of the Basque Country).

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Groupwork | 3 | 0 % |
| Group discussion | 4 | 100 % |
| Discussion | 4 | 100 % |
| Information presentation | 4 | 100 % |
| Handling sources and resources | 4 | 50 % |
| Tutorials | 4 | 50 % |
| Presentation and defence of projects | 6 | 100 % |
| Student's personal work | 8 | 0 % |
| Case studies | 8 | 100 % |
| Drawing up reports and presentations | 10 | 0 % |
| Expositive classes | 20 | 100 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 15 | | | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Attendance and participation | 20 % | 40 % |
| Critical debate in the classroom | 20 % | 40 % |
| Continuous evaluation | 10 % | 30 % |
| Presentations | 20 % | 40 % |
| Practical tasks | 10 % | 30 % |
| Written preparation of the final master's dissertation | 20 % | 40 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

ORGANIZATION OF THE SUBJECT, ASSESSMENT PROCEDURES AND THE STUDENT'S LEARNING TASKS

Overall assessment will take into account the achievement of objectives, acquisition of skills and assimilation of the course contents. This will include attendance at classes and active participation in the classroom, as well as attendance at proposed activities and the submission of assignments.

Assignments may be submitted in either of the two official languages of the Basque Autonomous Country (Spanish and Basque) or in English. Likewise, if pupils are interested in carrying out their final assignment in English, lecturers will ensure proper monitoring and tutoring.

The weight of each of the activities in the final grade is as follows: 20% attendance at classes with active participation in them, 10% attendance at conferences, colloquia or other activity offered by teachers and 70% with tests and proposed tasks.

To pass the subject, it is compulsory to attend at least 80% of the face-to-face classes and take the tests and proposed tasks. In addition, the score achieved, after applying the planned weightings, must reach, at least, the threshold of 5. The tasks will be carried out as the course is developed, and will be presented on the dates determined and communicated by the teaching staff.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXTRAORDINARY CALL: GUIDELINES AND WAIVER

In the extraordinary call, the evaluation of the subject will be carried out through a final test with all the theoretical-practical contents that have been addressed during the course.

The final test will comprise 100% of the grade for the course.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

### Detailed bibliography

### Journals

EUROPEAN JOURNAL FAMILY BUSINESS
http://www.revistas.uma.es/index.php/ejfb

FAMILY BUSINESS REVIEW
https://journals.sagepub.com/home/fbr

JOURNAL OF FAMILY BUSINESS MANAGEMENT
https://www.emerald.com/insight/publication/issn/2043-6238

JOURNAL OF FAMILY BUSINESS STRATEGY
https://www.journals.elsevier.com/journal-of-family-business-strategy

### Web sites of interest

Chair in SMEs and Family Business of UPV/EHU: http://www.ehu.eus/es/web/catedra-empresa-familiar

Spanish Family Business Institute: http://www.iefamiliar.com/

International Family Enterprise Research Academy (IFERA): https://ifera.org/

Family Firm Institute: https://www.ffi.org/

Institute for Family Business: https://www.ifb.org.uk/

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business **Cycle** Not Applicable

**Degree** DIREM401 - Master in Business Management From An Innovation and Interna **Year** Not Applicable

## COURSE

502122 - Globalisation and financial management **Credits, ECTS:** 3

## COURSE DESCRIPTION

This course is optional and is taught in the first semester of the first year of the University Master in Business Management from Innovation and Internationalization. This subject is generally taken by students who come from different grades, such as: business administration and management, economics, engineering, law, advertising and communication, etc.
The students in this master must acquire the ability to have a critical and rational vision and, also a synthetic ability about readings, academicals articles and data around Business Management. It will explain and practice communicate skills, both with their peers / and with the academic community and with society in the fields of financial economics, market research and marketing, and Business Management. Thus, the main objective is that students become familiar with financial management from a perspective of financial globalization. Financial decisions in the company must be made efficiently and for them new technologies are an important instrument, but it is also important to make them understand the integration of ethical and sustainable commitment as essential components in their decisions. Students generally come with financial knowledge, as they have taken subjects such as Financial Management: Financing (2nd year of ADE and 4th GADEDE) or Management of Financial Markets (4th year). In the case of students who have not completed finance subjects in their grades, they are provided with supplementary materials so that they can monitor the classes efficiently.
In particular, this subject includes a large part of the topics that are considered basic for the initial training of financial and management chief positions that require financial advisory skills. In this subject, in addition to the concepts of economic-financial globalization, financial management, treasury management, topics related to ethical behavior are included, or the inclusion of sustainable and / or ethical finance to instill students towards the fulfillment of the SDGs , specifically, the Sustainable Economy (SDG 8).
The starting point is the definition of the different financial entities and the framework in which they are developed. Subsequently, their management tasks are analyzed, focusing on those related to the sources of financing, investment and operations in the financial markets, as well as the adequate management of the risks assumed. It ends with a global vision, studying the different strategic lines followed by credit institutions.
The teachers who explain this subject promote academic ethics by encouraging sensitivity and perception of the ethical aspects of students, both in their attitude within the classroom and in the performance of individual or team work and various tasks and practices throughout the course.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Potenciar la capacidad investigadora en finanzas: desarrollar las habilidades para identificar, analizar, estudiar y dar solución a los problemas científicos en finanzas
Comprender el nuevo entorno financiero que rodea a las empresas
Aprender a identificar los posibles efectos derivados de fenómenos aún emergentes
Desarrollar la capacidad de adaptación al nuevo entorno empresarial
Comprender los fundamentos de la gestión de tesorería
Aprender a identificar los efectos de una modificación de la política de dividendos sobre el valor de la empresa
Aprender a identificar la metodología de investigación empírica que se ajusta al objetivo de un trabajo.
Aprender a identificar y valorar los problemas éticos en las finanzas

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Contents:
Part I: Research in Finance
-The purpose of the research in finance: problem and research questions
-The publication in international high quality journals
-Empirical studies in Corporate Finance
Part II: Cash Management
- Treasury Management vs. Cash Management
- Treasury Management: a financial culture
- Information and Communication Technologies in cash management
-New technologies
Part III: Ethics in Finance
-New perspectives of finance: from benefit to values
-Sustainability Finance

-The case of ethics in trade credit and cash holding
-Ethical banks and Social efficiency of banking
Part IV: Economical and Financial Globalisation
- Concept and origin of economic and financial globalization
- The development context of the economic and financial globalization process
- Level achieved in economic and financial globalization
- Positive effects and negative effects of globalization
Part V: Adaptation of business financial management to financial globalization
- Adaptation of the financial function
- Adaptation of the tasks to be performed by the financial function
-Country risk

Note: At the beginning of the semester the students will receive (through the web) a detailed schedule of the different topics. Exercises and notes will be uploaded to the web system for the students to work on them. The basic bibliography will be provided using university platform.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Readings | 10 | 0 % |
| Student's personal work | 15 | 0 % |
| Group discussion | 20 | 40 % |
| Expositive classes | 30 | 100 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 15 | | | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Attendance and participation | 15 % | 35 % |
| Evaluation by means of the presentation of projects | 10 % | 25 % |
| Presentations | 15 % | 35 % |
| Questions to discuss | 10 % | 30 % |
| Writing up the teamwork | 15 % | 35 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

1. A compulsory written test (10% of the final grade), which will consist of various questions of theoretical and practical content.
2. Carrying out activities - classroom practices and group work - (40% of the final grade):
i. Task 1: use of ICTs to detect ethical problems in the area of finance and their defense in written and oral form (with recording) (15% of the final grade).
ii. Task 2: critical reflection of current articles on financial globalization (25% of the final grade).
b. The development of activities (individual or in group) of a participatory and compulsory nature in the classroom will allow obtaining the remaining 5 points (50% of the final grade). In total, various practices will be carried out (depending on the academic year-see on eGela):
i. Practice 1: search, read and comment on articles and information related to financial globalization.
ii. Practice 2: search for information and presentation on ethical concepts
iii. Practice 3: analysis using Excel of financial decisions
iv. Practice 4: feedback between the students and the exhibitions. Opinions.

Teaching will be done in person (or bimodally, if the size of the group does not make it possible for all the students to attend the classroom in person). If for health reasons classroom attendance is not allowed in the classroom, it will go to online teaching and assessment. All information will be upload in eGela.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Same that ordinary.

Teaching will be done in person (or bimodally, if the size of the group does not make it possible for all the students to attend the classroom in person). If for health reasons classroom attendance is not allowed in the classroom, it will go to online teaching and assessment. All information will be upload in eGela.

## MANDATORY MATERIALS

There is no mandatory manual, but the students will gest resources upload and share by the professor (slides and articles). It will reduce the taking of notes during classrooms. This material will be available in the eGela. If someone needs for any reason the materials can be provided via mail / wetransfer or give more materials about it.

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GUITIÁN, M. y F. VARELA (2000): Sistemas financieros ante la globalización. Pirámide, Madrid.
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HARDOUVELIS, G.; D. MALLIAROPULUS y R. PRIESTLEY (2003): ¿The impact of globalization on the equity cost of capital¿. Social Science Research Network (SSRN) Working Paper, febrero, pp. 42.
ITURRALDE, I.; MASEDA, A. & SAN-JOSE, L. (2004): ¿Cash Management: análisis empírico de una cultura financiera¿, Revista Iberoamericana de Contabilidad y Gestion, II (1), 151-175.
ITURRALDE, I.; MASEDA, A. & SAN-JOSE, L. (2009): ¿The cash management routines: Evidence from Spanish case¿, Frontiers in Finance and Economics, forthcoming.
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OBSTFELD, M. y A.M. TAYLOR (2002): ¿Globalization and capital markets¿. National Bureau of Economic Research (NBER) Working Paper, nº 8846, Cambridge, pp. 67.
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in M Khosrow-Pour (Ed), Encyclopedia of information science and technology (pp. 3914- 3920). Hershey, PA: Information Science Publishing. Second Edition.
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STULZ, R.M. (1999a): ¿Globalization of equity markets and the cost of capital¿. National Bureau of Economic Research (NBER) Working Paper, nº 7021, Cambridge, pp. 70.
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**Detailed bibliography**

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- Estrategia financiera: http://www.estrategiafinanciera.es/
- Inversión y finanzas.
- Finanzas.com: http://www.finanzas.com/
- Diario expansión: http://www.expansion.com/
- El economista: http://www.eleconomista.es/
- El confidencial: http. //www.elconfidencial.com
-Corresponsables: https://www.corresponsables.com

Monográficos
ARESTIS, P. y S. BASU (2003): ¿Financial globalization and regulation¿. The Levy Economics Institute of Bard College Working Paper, nº 397, pp. 19.
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**Web sites of interest**

Direcciones web de utilidad
ASSET. TESOREROS DE ESPAÑA: https://asset.es/
BANCA ÉTICA: http://bancaetica.cat/es/
BANCO CENTRAL EUROPEO: http://www.ecb.int/ecb/html/index.es.html
BANCO DE ESPAÑA: http://www.bde.es
COMISIÓN NACIONAL DEL MERCADO DE VALORES: http://www.cnmv.es
ECONOMYWEB: http://www.economyweb.com
EUROPEAN BUSSINESS ETHICS NETWORK: https://www.eben-spain.org/
EUROPEAN FINANCE ASSOCIATION: http://european-finance.org/r/home
FINANZAS PARA TODOS: http://www.finanzasparatodos.es/
INSTITUTO SUPERIOR TECNICAS/PRACTICAS BANCA: http://www.iberfinanzas.com
POLITICAS DE LA UNION EUROPEA: http://europa.eu.int/scadplus/leg/es/l00000.htm
UNIÓN EUROPEA: http://www.europa.eu.int/index-es.htm

BLOGS…
http://www.loyolaandnews.es/seccion/blogs-tematicos/etica-y-finanzas/
https://blog.iese.edu/antonioargandona/
http://blog.cristianismeijusticia.net/2012/03/16/hacia-unas-finanzas-eticas-al-servicio-de-los-pueblos-por-jordi-mari

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business | **Cycle** Not Applicable

**Degree** ECONO802 - Master in Economics: Economic Analysis Tools | **Year** Not Applicable

## COURSE

503485 - Econometrics | **Credits, ECTS:** 4

## COURSE DESCRIPTION

Econometrics is a compulsory subject in the Interuniversity Master's Degree in Economics: Tools of Economic Analysis. It is taught simultaneously and in a coordinated way in the three universities that offer this program.

The work developed in this course allows students to use the linear regression model to analyze the behavior of economic variables using the data available (cross-sectional, time series and panel). The regression model will be studied in depth, with special emphasis on the alternative estimators used in the case of non-compliance with the assumptions.

Knowledge of descriptive statistics and probability theory as well as statistical inference is necessary to follow this Econometrics course properly. In addition, it is necessary to know how to use linear and matrix algebra at a basic level.

The linear regression model is a useful model to apply in those subjects that require the analysis of economic models for decision making.

Specific Competences

To acquire a solid knowledge of modern statistical-econometric methods for the quantification of economic relations, the comparison of theories and the evaluation of public policies.

To know and use the different sources of microeconomic and macroeconomic data relevant for the evaluation of the labour market situation: labour force survey, salary structure survey.

To understand the logic of modelling and econometric methods for the analysis of time series and cross-section data, as well as their usefulness in economic forecasting.

Carry out empirical work, selecting the appropriate statistical-econometric methods according to the nature of the data and the problem to be analyzed and using specialized computer programs.
To interpret and transmit the results of a quantitative analysis and to prepare reports.

In addition to the basic competencies of this course, the following Transversal Competencies are worked on throughout the course:

CT1692 - Managing information and communication technologies in your professional and research performance in the field of economic analysis.
CT1702 - Planning tasks, organizing resources and managing time efficiently.
CT1709 - To identify and solve specific problems by developing the capacity for analysis and synthesis.
CT1711 - Communicate fluently, both orally and in writing in Spanish, and read, understand and write texts in English.

The learning outcomes of this course, related to the specific competences are

- To apply economic theory to represent real-life situations.

- To interpret in economic terms the mathematical results of formal models.

- To know how to look for information relevant to evaluate the economic situation both at a territorial level and in the different markets of interest: labour, financial, ..., using different sources of microeconomic and macroeconomic data

- To understand the logic of econometric modelling for the analysis of time series. cross-section and panel data.

- To acquire solid knowledge of modern statistical-econometric methods for the quantification of economic relations, the contrast of theories and prediction.

- To apply the econometric-statistical methods for the analysis and evaluation of economic policies, whether at the public or private, local, national or international level.

- To carry out empirical work, selecting the appropriate statistical-econometric methods according to the nature of the

data and the problem to be analysed and using specialised computer programmes.

- To interpret and transmit the results of a quantitative analysis and prepare reports.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Manejar los métodos estadístico-econométricos diseñados para el análisis y evaluación de políticas públicas.
Conocer y utilizar las distintas fuentes de datos microeconómicos y macroeconómicos relevantes para evaluar la situación del mercado de trabajo: encuesta de población activa, encuesta de estructura salarial.
Conocer los procedimientos para estimar y contrastar las consecuencias de la unión económica, con especial atención a la evaluación de las políticas económicas europeas actuales destinadas al logro de la convergencia.
Conocer y utilizar las fuentes de datos estadísticos y las herramientas econométricas que permiten contrastar las teorías económicas relativas a la Economía industrial.
Comprender la lógica de la modelización y los métodos econométricos para el análisis de datos de series temporales y de sección cruzada, así como su utilidad en la predicción económica.
Adquirir conocimientos sólidos de los métodos estadístico-econométricos modernos para la cuantificación de las relaciones económicas, el contraste de teorías y la evaluación de políticas públicas.
Realizar trabajos empíricos, seleccionando los métodos estadístico-econométricos apropiados según la naturaleza de los datos y el problema a analizar y utilizando los programas informáticos especializados.
Interpretar y transmitir los resultados de un análisis cuantitativo y elaborar informes.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

demás de las competencias básicas de la asignatura recogidas en la memoria de la titulación, a lo largo del curso se trabajan las siguientes Competencias Transversales:

CT1692 - Manejar las tecnologías de la información y comunicación en su desempeño profesional e investigador en el campo del análisis económico.
CT1702 - Planificar tareas, organizar recursos y gestionar de forma eficiente el tiempo.
CT1709 - Identificar y resolver problemas concretos desarrollando la capacidad de análisis y de síntesis.
CT1711 - Comunicarse de forma fluida, tanto de forma oral como escrita en castellano, así como leer, comprender y redactar textos en inglés.
CT- Compromiso social (comprensión crítica de la problemática socio-ambiental global)

Los resultados de Aprendizaje de esta asignatura, relacionados con las competencias específicas de la asignatura son:

- Aplicar la teoría económica para representar situaciones reales.
- Interpretar en términos económicos los resultados matemáticos de modelos formales.
- Saber buscar información en las distintas fuentes de datos microeconómicos y macroeconómicos relevantes para evaluar la situación económico tanto a nivel territorial como de los distintos mercados de interés: laboral, financiero, ...
- Comprender la lógica de la modelización econométrica para el análisis de datos de series temporales y de sección cruzada.
- Adquirir conocimientos sólidos de los métodos estadístico-econométricos modernos para la cuantificación de las relaciones económicas, el contraste de teorías y la predicción.
- Aplicar los métodos estadístico-econométricos para el análisis y evaluación de políticas económicas, tanto a nivel público como privado, local, nacional o internacional.
- Realizar trabajos empíricos, seleccionando los métodos estadístico-econométricos apropiados según la naturaleza de los datos y el problema a analizar y utilizando los programas informáticos especializados.
- Interpretar y transmitir los resultados de un análisis cuantitativo y elaborar informes.
- Emitir juicios fundamentados sobre temas relevantes de índole socio-económico y ambiental a partir de la interpretación de datos y utilizando los modelos econométricos apropiados.

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. Review of the basic concepts of probability, distribution functions and mathematical statistics necessary for this course.

2. Specification, estimation and inference of the general linear regression model under the linear regression assumptions.

3. Generalization of the  linear regression model and presentation of a general estimation method that allows working under different sets of assumptions.

4. Study of the specific problems raised by time series data: violation of the assumptions of stationarity and absence of autocorrelation.

5. An introduction to panel data models, both fixed and random effects.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Theory | 2,5 | 100 % |
| Seminars | 8,5 | 50 % |
| Classroom practicals | 12 | 50 % |
| Computer practicals | 21,4 | 33 % |
| Lectures | 55,6 | 36 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 20 | 4,5 | 6 | | 7 | | | 2,5 | |
| Horas de Actividad No Presencial del Alumno/a | 35,6 | 4 | 6 | | 14,4 | | | 0 | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 40 % | 60 % |
| Presentations | 20 % | 40 % |
| Questions to discuss | 10 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The ordinary assessment session is structured as follows:

50% of the grade for the subject is obtained by answering exercises, case studies and problems individually and in groups.

50% of the grade for the subject is obtained by means of an individual written exam in which students must answer theoretical questions and solve problems related to the theoretical and practical contents taught on the subject. This exam is the same in the three universities that offer this programme.

Students may decline to take part in the ordinary assessment session by merely notifying the faculty in writing up to one week before the official exam date.

The faculty who teach this subject reserve the right to modify the evaluation system because of causes of major force. Any change will be announced on the e-gela platform in good time and in an appropriate manner.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary assessment session assessment consists of an individual exam (which accounts for the entire grade awarded) covering all the learning outcomes for the subject. It will take place on the date set on the offical course calendar.

Students may decline to take part in the extraordinary assessment session by merely notifying the faculty in writing up to one week before the official exam date.

The faculty who teach this subject reserve the right to modify the evaluation system because of causes of major force. Any change will be announced on the e-gela platform in good time and in an appropriate manner.

## MANDATORY MATERIALS

Egela platform

Econometric software Gretl

## BIBLIOGRAFÍA

### Basic bibliography

Stock, J. y M. Watson (2003). Introduction to Econometrics. Ed. Pearson Education.

Wooldridge, J.M. (2003). Introducción a la Econometría. Ed. Thomson Learning. 2ª edición.

### Detailed bibliography

Heij, C, P. de Boer, P.H. Franses, T. Kloek y H. van Dijk (2004). Econometric Methods with applications in Business and Economics. Oxford Unversity Press.

Ramanathan, R. (2002). Introductory Econometrics with Applications. Ed. Thomson Learning, 5ª edición.

Verbeek, M. (2004) Guide to modern econometrics. Ed. Wiley.

### Journals

Journals (Spanish)
http://www.revecap.com Revista de Economía Aplicada
http://www.revistaestudiosregionales.com Revista de Estudios Regionales
http://www.funep.es/invecon/sp/sie.asp Investigaciones Económicas
http://www1.euskadi.net/ekonomiaz Ekonomiaz

Journals (English)
Computational Economics
Econometrica
Econometric Reviews
Econometric Theory
Empirical Economics Journal
International Journal of Forecasting
Journal of Applied Econometrics
Journal of Business and Economic Statistics
Journal of Econometrics
Journal of Economic Dynamics and Control
Journal of Forecasting
Oxford Bulletin of Economics and Statistics
Review of Economics and Statistics
Review of Economic Studies
Studies in Nonlinear Dynamics and Econometrics

### Web sites of interest

Software

http://gretl.sourceforge.net GRETL. Paquete econométrico, Manual para el usuario y Datos (versión en castellano).

Institutions
http://www.eustat.es EUSTAT
http://www.ogasun.ejgv.euskadi.net. Departamento de Economía y Hacienda. Gobierno Vasco. Bases de datos: Ikerbide, Udalmap, ¿
http://www.ine.es INE
http://www.meh.es Ministerio de Economía y Hacienda
http://www.bde.es Banco de España.
http://ec.europa.eu/eurostat EUROSTAT
http://www.ecb.int/ Banco Central Europeo
http://www.oecd.org OECD
http://www.imf.org Fondo Monetario Internacional.
http://www.worldbank.org Banco Mundial.

Datos
http://www.nber.org/data_index.html
http://www.estadief.minhac.es/
http://fisher.osu.edu/fin/osudown.htm
http://econ.queensu.ca/jae/
http://www.psidonline.isr.umich.edu/data/

http://www.census.gov/

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business **Cycle** Not Applicable

**Degree** ECONO802 - Master in Economics: Economic Analysis Tools **Year** Not Applicable

## COURSE

503486 - Methods of Statistical Inference **Credits, ECTS:** 3

## COURSE DESCRIPTION

This is a course on Statistical Inference based on a Decision Theory perspective. In this course the student will be introduced to the required statistical tools that will allow him/her to be able to state and make formal statements about statistical inference processes within an economical framework. The course includes an initial introduction to Statistics viewed from the Theory of Decision perspective, so that specific criteria for selecting optimal statistical procedures can be stated. These criteria will allow the student to be able to study topics on parameter estimation methods and their specific properties, as well as on convergence and hypothesis testing.

The main objective of this course is that the students become familiar and are able to efficiently use all of the provided elements from basic and advanced statistical inference from a Bayesian perspective: point and interval estimation, properties of estimators, and hypothesis testing, which will require a previous study of some of the most commonly used and necessary probability distributions in Statistics. The material included in this course will allow the student to be able to state and solve specific problems in statistical inference, required for any data analysis process, as well as to carry out any quantitative analysis or study related to the student's specific field.

SPECIFIC SKILLS:
- Identify and be able to select the most appropriate characteristics of the different theoretical probability models (discrete and continuous) for each case and, thus, be able to assess their utility and applicability in the specific professional field under study.
- Assess the different problems in statistical inference to be able to appropriately select the best alternative of analysis.
- Be able to apply the available statistical methods to take the most adequate decision on the basis of professional and methodological criteria.
- Select the most appropriate source of information to be able to study the specific problem of interest and, in addition, be able to analyze data sets using the most adequate statistical technique under each setting.
- Be able to interpret and communicate the results of the different analyses, using clear and concise statements, as well as tools from the up-tp-date technologies of information (TICs).

CROSS SECTIONAL SKILLS:
- Be able to state motivated judgements based on the results obtained from the different data analyses.
- Be able to fluently communicate in an oral and written form.
- Be able to participate in team-work, with responsability and showing respect for others, as well as displaying initiative and leadership within the group.
- Be able to carry out analytical judgements and critical statements on given settings within the specific fields of study.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Aplicar los criterios y la metodología del análisis económico para obtener procedimientos generales de diseño y análisis de políticas públicas: estructuración de problemas, pronóstico, recomendación y evaluación.
Manejar los métodos estadístico-econométricos diseñados para el análisis y evaluación de políticas públicas.
Conocer los principios del análisis económico más relevante en la gestión óptima de los recursos naturales, teniendo en cuenta que la incertidumbre y la irreversibilidad juegan un papel muy importante.
Manejar los modelos y las técnicas microeconométricas, así como los programas informáticos habituales en el análisis empírico del mercado de trabajo.
Realizar tareas de consultoría y asesoramiento en el diseño de estrategias empresariales y de políticas económicas locales adaptadas a las condiciones de integración económica.
Realizar trabajos empíricos, seleccionando los métodos estadístico-econométricos apropiados según la naturaleza de los datos y el problema a analizar y utilizando los programas informáticos especializados.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Chapter 1. STATISTICS AND DECISION THEORY.
Definition of statistical procedures. Theory of Decision's perspective: States of Nature, decision space, sample space, loss function. Expected loss. Bayes risk. Admissible Procedures.
Recommended References: Kiefer (1983) Chap.1, 2 and 3. Berger (1985) Chap.2. Lehmann (1983) Chap.1, Sec.1.

Bickel-Doksum (1977) Chap. 10. Ferguson (1967) Chap. 1 and 2.

Chapter 2. SELECTION CRITERIA FOR STATISTICAL PROCEDURES (I).
Bayes criterion. Randomization of statistical procedures. Complete classes. Minimax criterion: characterization. Characterization of admissible procedures. Least favorable distributions. Computing minimax procedures. Relation between minimax and Bayes procedures.
Recommended references: Kiefer (1983) Chap.4. Lehmann(1983) Chap. 4. Bickel-Doksum (1977) Chap. 10. Ferguson (1967) Chap. 1 and 2.

Chapter 3. SELECTION CRITERIA FOR STATISTICAL PROCEDURES (II).
What to do if we do not have a specific loss function? Unbiased estimation. Maximum likelihood estimation method. Method of moments estimation method. Frequency substitution estimation method. Least squares estimation method.
Recommended references: Kiefer (1983) Chap. 4. Bickel-Doksum (1977) Chap. 3.

Chapter 4. SUFFICIENCY.
Characterizacion of sufficiency. Families of distributions. Exponential family. Sufficient statistics and the exponential family. Sufficient statistics and Bayes solutions. Characterization of the minimal sufficiency. Complete statistics.
Recommended references: Kiefer (1983) Chap.4. Lehmann (1983) Chap.1 Sec. 5. Cox-Hinkley (1974) Chap. 2 Sec. 2. Cox-Hinkley (1978). Ferguson (1967) Chap. 3.

Chapter 5. POINT ESTIMATION. SOME BASIC RESULTS.
The condition of unbiasedness. Convex functions. UMVU estimators. Rao-Blackwell's Theorem. Lehmann-Scheffé's Theorem. Cramér-Frechet-Rao's inequality. Chapman-Robbins-Kiefer's inequality. Efficiency and asymptotic efficiency. Equivariance (or "invariance"). Hunt-Stein's Theorem.
Recommended references: Kiefer (1983) Cap. 7. Lehmann (1983) Chap. 2 and 3. Bickel-Doksum (1977) Chap. 4. Rohatgi (1976) Chap. 8.

Chapter 6. STOCHASTIC CONVERGENCE AND ASYMPTOTIC PROPERTIES.
Sequences of random variables. Types of convergence. Law of large numbers. Central limit theorem. Weakly and strongly consistent estimation sequences. Rates of consistency. The median as location estimator. Asymptotic distribution of method of moments estimators.
Recommended readings: Kiefer (1983) Chap. 7. Rao (1965) Sec. 2.c. Lehmann (1983) Chap. 5. Cox-Hinkley (1974) Appendix A.

Chapter 7. POINT ESTIMATION. THE MAXIMUM LIKELIHOOD METHOD.
Maximum likelihood estimation and sufficient statistics. Asymptotic properties: consistency (Wald's Theorem), asymptotic normality, asymptotic efficiency. B.A.N. estimators ("normally asymptotically optimal").
Recommended readings: Kiefer (1983) Chap. 7. Lehmann (1983) Chap. 6. Cox-Hinkley (1974) Chap.8 and 9. Cox-Hinkley (1978).

Chaoter 8. HYPOTHESIS TESTING.
Test statistics and their null distribution. Decision theory perspective on hypothesis testing. Simple hypothesis testing. Composite hypothesis testing. Discarding nuisance parameters. Pure, simple and composite tests of hypothesis. Randomized tests. Most powerful tests: Neyman-Pearson's Theorem. Uniformly most powerful tests. Uniformly most powerful unbiased tests. Most powerful and unbiased local tests. Equivariant tests. Generalized maximum likelihood ratio tests.
Recommended readings: Kiefer (1983) Chap. 8. Cox-Hinkley (1974) Chap. 3 and 5. Lehmann (1959) Chap. 3. Ferguson (1967) Chap. 5. Bickel-Doksum (1977) Chap. 5 and 6.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Theory | 5 | 100 % |
| Seminars | 7 | 0 % |
| Computer practicals | 8 | 0 % |
| Classroom practicals | 15 | 66 % |
| Lectures | 40 | 37 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 0 | 10 | | 0 | | | 5 | |
| Horas de Actividad No Presencial del Alumno/a | 25 | 7 | 5 | | 8 | | | 0 | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 30 % | 40 % |
| Otros: Participación en clase | 10 % | 20 % |
| Questions to discuss | 40 % | 60 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Grading in this course is based on take-home homework assgined to students along the course, as well as on the active students' participation, both individually and as a team, and in the discussion resulting from the real problems' solutions related to the material included in the practical sessions about the specific contents in the course program. The solution to exercises and problems in the practical sessions, in the seminars, and in the lecture sessions will be part of the students' on-going evaluation grades.

Class participation in class: 20% of the final grade
Regular take-home homework: 80% of the final grade

Students not handling all of the assigned homework will have a "Failing" grade. Students handling no homework at all will have an "Absent" grade. Homework: The work submitted by the students must be their own work and must have been written completely by themselves. The students must identify and include the source of all facts, ideas, opinions and viewpoints of others through in-text referencing and the relevant sources should all be included in the list of references at the end of their work. Direct quotations from books, journal articles, internet sources or any other source must be acknowledged and the sources cited must be identified in the list of references.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The second call grade will be solely based on a final exam. The final exam will include all of the material included in the course program. The use of mobile or electronic devices, notes, books is not allowed in this exam.

## MANDATORY MATERIALS

COMPULSORY REFERENCES:

Lehmann, E.L. (1959). Testing Statistical Hypothesis. New York: Wiley.
Lehmann, E.L. (1983). Theory of Point Estimation. New York: Wiley.

## BIBLIOGRAFÍA

### Basic bibliography

RECOMMENDED ADDITIONAL REFERENCES:

Ferguson, T.S. (1967). Mathematical Statistics: A Decision Theoretic Approach. Academic Press: New York.

Lehmann, E.L. (1959). Testing Statistical Hypothesis. Wiley: New York.

Lehmann, E.L. (1983). Theory of Point Estimation. Wiley: New York.

### Detailed bibliography

ADDITIONAL REFERENCES:

Berger, J.O. (1985). Statistical Decision Theory and Bayesian Analysis. Springer Verlag: New York.

Bickel, P.J. y Doksum, K.A. (1977). Mathematical Statistics. Holden-Day, Inc.: Oakland.

Cox, D.R. y Hinkley, D.V. (1974). Theoretical Statistics. Chapman and Hall: London.

Cox, D.R. y Hinkley, D.V. (1978). Problems and Solutions in Theoretical Statistics. Chapman and Hall: London.

Garthwaite, P.H., Jolliffe, I.T. y Jones, B. (1995). Statistical Inference. Prentice Hall: London.

Kiefer, J.C. (1983). Introduction to Statistical Inference. Springer Verlag: New York.

Lindley, D.W. (1969). Introduction to Probability and Statistics from a Bayesian Viewpoint. Cambridge University Press: Cambridge.

Migon, H.S. y Gammerman, D. (1999). Statistical Inference. An Integrated Approach. Arnold: London.

Peña, D. (2001). Fundamentos de Estadística. Alianza Editorial: Madrid.

Rao, C.R. (1965). Linear Statistical Inference and its Applications. Wiley: New York.

**Journals**

JOURNALS:

Applied Statistics
Applied Stochastic Models in Business and Industry
Biometrics
Biometrika
Biostatistics
Communications in Statistics ¿ Computation and Simulation
Communications in Statistics ¿ Theory and Methods
Journal of Applied Statistics
Journal of the American Statistical Association
Journal of the Royal Statistical Society ¿ Series B
Journal of Statistical Computation and Simulation
Journal of Statistical Planning and Inference
Methodology ¿ European Journal of of Research Methods for the Behavioral and Social Sciences
Statistics in Medicine
Statistical Methods in Medical Research
Statistical Modelling
The American Statistician

**Web sites of interest**

WEBSITES:

American Statistical Association (http://www.amstat.org/)
Biostatnet (http://eio.usc.es/pub/biostatnet/)
International Statistical Institute (http://www.isi-web.org/)
International Biometric Society (http://www.biometricsociety.org/)
Royal Statistical Society (http://www.rss.org.uk/)
Sociedad Española de Estadística e Investigación Operativa (http://www.seio.es/)
Sociedad Española de Biometría (http://biometricsociety.net/)

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business | **Cycle** Not Applicable

**Degree** ECONO802 - Master in Economics: Economic Analysis Tools | **Year** Not Applicable

## COURSE

503488 - Statistics and Time Series Topics | **Credits, ECTS:** 6

## COURSE DESCRIPTION

This course allows the student to deepen in the different techniques used in the analysis of economic time series and its statistical treatment, putting special emphasis in the analysis in the frequency domain and dynamic volatility models. The aim is to enable students to carry out quality research in the field of economic analysis by applying advanced statistical and econometric instruments and knowledge. At the end of the course the student should know how to extract information from an economic series, use different statistical and econometric packages, and master both semi-parametric and non-parametric statistical models. Likewise, the student must know the characteristics and utilities of the integrated and fractional processes and of the changing volatility models, especially important in financial series.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Comprender la lógica de la modelización y los métodos econométricos para el análisis de datos de series temporales y de sección cruzada, así como su utilidad en la predicción económica.
Adquirir conocimientos sólidos de los métodos estadístico-econométricos modernos para la cuantificación de las relaciones económicas, el contraste de teorías y la evaluación de políticas públicas.
Identificar, buscar, organizar y sistematizar la información estadística relevante para ayudar a explicar las cuestiones económicas de interés, tanto a nivel microeconómico como macroeconómico.
Realizar trabajos empíricos, seleccionando los métodos estadístico-econométricos apropiados según la naturaleza de los datos y el problema a analizar y utilizando los programas informáticos especializados.
Interpretar y transmitir los resultados de un análisis cuantitativo y elaborar informes.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

First part of the course is devoted to the Time series volatility analysis. The tools needed to perform a detailed time series analysis in the frequency domain, alternative to the traditional time domain, are presented and described. The concepts of cycle, distribution, spectral density, linear filters, the periodgram and estimators of spectral density functions are introduced.
The second part of the course is devoted to the Time series analysis in the frequency domain. It is focused on basic concepts of frequency domain, Fourier analysis, estimation in the frequency domain and fractional integration Several financial models for dynamic heterocedasticity, both within the ARCH and Stochastic Volatility approaches are described.
The third part of the course is focused on non-linearities in Econometrics. It aims at maximum likelihood estimation,, numerical optimization methods, non-linear regression, identifiability and specification tests.
The last fourth part is devoted to the software package R for statistical and graphical analysis that has a dual nature of program and programming language. R has many functions for statistical and graphical analysis

A. Time series volatility analysis

1. Introduction: Statistical characteristics of the financial series
2. ARCH models and extensions
3. Stochastic volatility models

B. Time series analysis in the frequency domain

1. Basic concepts of frequency domain
2. Fourier analysis
3. Estimation in the frequency domain
4. Long memory in time series: Fractional integration

C. Non-linearity in Econometrics

1. Maximum likelihood
2. Numerical optimization methods
3. Non-linear regression: Numerical calculation algorithms
4. Maximum likelihood estimation: Numerical calculation algorithms
5. Identifiability
6. Specification tests

D. Programming in R

1. Introduction
2. Basic commands
3. Linear regression
4. Time Series Analysis: Box-Jenkins Methodology
5. Non-linearity in the estimation by Maximum Likelihood

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Theory | 5 | 100 % |
| Seminars | 15 | 33 % |
| Classroom practicals | 20 | 50 % |
| Computer practicals | 30 | 33 % |
| Lectures | 80 | 37 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 30 | 5 | 10 | | 10 | | | 5 | |
| Horas de Actividad No Presencial del Alumno/a | 50 | 10 | 10 | | 20 | | | 0 | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 40 % | 60 % |
| Questions to discuss | 40 % | 60 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The final grade is composed of the qualification obtained from subjects A and B (50%) and topics C and D (50%).

Grading of topics A and B will be based on individual problems and a final exam. Grading of topics C and D will be based on the assignments students will have to do throughout the school term. There are a total of 6 assignments in topics C and D. Each assignment will have the following weight in the grading of topics C and D:

Task 1: 10%
Task 2: 10%
Task 3: 10%
Task 4: 10%.
Task 5: 10%
Task 6: 50%

The evaluation will preferably be in-classroom. If this is not possible, the final exam will be taken using the services available at Egela. The student will have a limited time to download the final exam form from Egela and upload the solution to that platform (preferably in pdf and in any case in a perfectly legible format to enable evaluation). This exam is individual, so in order to guarantee it the teaching team of the course might request an oral interview of verification of the answers after the correction of the exam with an individualized conversation with the student.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Evaluation by means of a final written test.

## MANDATORY MATERIALS

Andersen, T.G., Davis, R.A., Kreib. J.P. and Mikosch, T. (2009). Handbook of Financial Time Series. Springer-Verlag Berlin.

Beran, J. (1994) Statistics for Long-Memory Processes. Chapman & Hall.

Fomby, T., Hill, C. & Johnoson, S. (1984), Advanced Econometric Methods, Needham, MA, Springer-Verlag.

Greene, W. H. (1993), Econometric Analysis, Macmillan Publishing Company, New York.

Fox, J. (2005), An R and S-plus companion to applied regression, Sage Publications, Thousand Oaks, California.

## BIBLIOGRAFÍA

### Basic bibliography

Bollerslev, T., Engle, R.F. and Nelson, D.B. (1994). ARCH Models. Handbook of Econometrics, Vol. IV, Engle R.F and McFadden D.L., eds., 2959-3038.

Brockwell, P.J. and Davis, R.A. (1991) Time Series: Theory and Methods. Springer-Verlag New York, Inc.

Harvey, A.C. (1993) Time Series Models. Harvester Wheatsheaf.

Cramer, J. (1986), Econometric Applications of Maximum Likelihood methods, Cambridge University Press, Cambridge.

Faraway, J. (2005), Linear models with R, Chapman & Hall/CR, Boca Raton.

Fox, J. (2005), An R and S-plus companion to applied regression, Sage Publications, Thousand Oaks, California.

### Detailed bibliography

Bollerslev, T., Engle, R.F. and Nelson, D.B. (1994), ARCH Models. Handbook of Econometrics, Vol. IV, Engle R.F and McFadden D.L., eds., 2959-3038.

Brockwell, P.J. and Davis, R.A. (1991), Time Series: Theory and Methods. Springer-Verlag New York, Inc.

Horowitz, J. L. (1998), Semiparametric methods in econometrics. Lecture Notes in Statistics, 131. Springer-Verlag, New York.

Pagan, A. and A. Ullah (1999), Nonparametric econometrics. Themes in Modern Econometrics. Cambridge University Press, Cambridge.

Priestley, M.B. (1992), Spectral Analysis and Time Series. Academic Press LTD.

Rossiter, D.G. (2006), Introduction to the R Project for statistical computing for use at ITC, Internacional Institute for Geo-information Science & Earth Observation, Enschede (http://cran.es.r-project.org/doc/contrib/Rossiter-RIntro-ITC.pdf).

Venables, B., Smith, D., Gentleman R., Ihaka, R. and Mächler M. (1997), Notas sobre R: Un entorno de programación para Análisis de Datos y Gráficos, University of Auckland. (http://cran.r-project.org/doc/contrib/R-intro-1.1.0-espanol.1.pdf).

Verzani J. (2002), simpleR ¿ Using R for Introductory Statistics, CSI Math department (www.math.csi.cuny.edu/Statistics/R/simpleR).

### Journals

R Journal

### Web sites of interest

http://www.r-project.org/
www.tutorialr.es/

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business | **Cycle** Not Applicable

**Degree** ECONO802 - Master in Economics: Economic Analysis Tools | **Year** Not Applicable

## COURSE

503501 - Environmental Economics | **Credits, ECTS:** 3

## COURSE DESCRIPTION

The Environmental Economics course is an optional subject offered by the University of the Basque Country (Master in Economics: Economics Analysis Tools). This course explores the relationship between the economy and the environment. We show the tools that economic analysis provides for the study of the main environmental problems like local pollution, climate change, biodiversity loss or depletion of natural resources. Basic economic concepts to follow this course are offered by the compulsory subjects taken by the master’s students during the first part of the semester. At the same time, this course offers useful concepts and tools that will be used in different optional subjects that the students can take during the second and third semester (Natural Resource Economics and Environmental Policy, Regulation and Competition Policy, Analysis of Public Choice or Evaluation of Transport and Network Policies).
In case legal imperatives or safety reasons ban face to face interaction then teaching will be online.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocer los principios del análisis económico más relevante en la gestión óptima de los recursos naturales, teniendo en cuenta que la incertidumbre y la irreversibilidad juegan un papel muy importante.
Analizar el comportamiento de los mercados y de los agentes económicos para la correcta modelización de los problemas ambientales.
Identificar los objetivos y los requisitos que deben satisfacer las políticas medioambientales cuya finalidad sea la utilización eficiente de los activos ambientales y el desarrollo sostenible.
Conocer de forma precisa la legislación vigente, los acuerdos internacionales y la actuación de los organismos públicos en materia medioambiental.
Realizar labores de estudio, asesoramiento y diseño de políticas medioambientales que garanticen el desarrollo sostenible.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Environmental Economics explore the relationship between economics and the environment. Microeconomic analysis is used to analyze and explain environmental problems as market failures due to external effects, public goods or the absence of property rights. We present different economic instruments and environmental policies that are used to solve environmental problems with special emphasis in the case of Climate Change. Finally, we present the main methods and concepts used to value environmental assets and services.

Table of contents
Tema 1. Economics and the environment: Introduction
Tema 2. Economic instruments and environmental policy
Tema 3. Economic growth, the environment and Sustainable Development Goals
Tema 4. The Economics of Climate Change
Tema 5. Environmental Valuation: concepts and methods

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Seminars | 5 | 0 % |
| Theory | 5 | 100 % |
| Classroom practicals | 22,5 | 44 % |
| Lectures | 42,5 | 35 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 0 | 10 | | | | | 5 | |
| Horas de Actividad No Presencial del Alumno/a | 27,5 | 5 | 12,5 | | | | | 0 | |

**Legend:** M: Lecture-based | S: Seminar | GA: Applied classroom-based groups
GL: Applied laboratory-based groups | GO: Applied computer-based groups | GCL: Applied clinical-based groups

TA: Workshop TI: Industrial workshop GCA: Applied fieldwork groups

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 50 % | 70 % |
| Presentations | 10 % | 30 % |
| Questions to discuss | 10 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Class attendance is mandatory to follow continuous evaluation based on
(i) individual tasks;
(ii) active participation in roleplaying games on Climate Change;
(iii) oral presentation of individual work;
(iv) group assignments and class participation;

A final written exam will be mandatory for those students who fail the continuous evaluation. Any student who does not show up for the final exam will have "Not Submitted" as final grade.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Evaluation system on second round: there will be a single final written exam that counts 100% of the final grade.
It will comprise problems and long essays regarding the main issues discussed along the course.

## MANDATORY MATERIALS

Relevant documentation and study material (lecture slides and readings) will be posted on the course website. EGELA is the virtual classroom to support face-to-face teaching.

## BIBLIOGRAFÍA

### Basic bibliography

- R. Perman, Y. Ma, M. Common, D. Madison, J. McGilvray, 2011, Natural Resource and Environmental Economics, Pearson Education-Addison Wesley, 4ª ed.
- P. Riera, D. García, B. Kriström y R. Bränlund. Manual de Economía Ambiental y de los Recursos Naturales, Thomson Editores, 2005 (3º reimpresión 2011).
- Stavins Robert N. (ed.), 2019 (7º ed.) Economics of the Environment. Selected Readings, W.W. Norton and Company.

### Detailed bibliography

- Baumol W. J. y W. E. Oates, The Theory of environmental policy, Cambridge University Press, 1988.
- Field Barry & Martha K. Field: Economía Ambiental, McGraw-Hill, 2003.

### Journals

Ecological Economics
Review of Environmental Economics and Policy
Journal of Environmental Economics and Management
Environmental and Resource Economics
Resource and Energy Economics
Energy Economics
Land Economics
American Economic Review
Journal of Political Economy

### Web sites of interest

NEP (New Economic Papers) (http://nep.repec.org/)
The Economics of Ecosystem and Biodiversity (http://www.teebweb.org/)
Pew Center on Global Climate Change (USA) (http://www.c2es.org/)
BC3 (Basque Center for Climate Change) (http://www.bc3research.org/)

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business **Cycle** Not Applicable

**Degree** ECONO802 - Master in Economics: Economic Analysis Tools **Year** Not Applicable

## COURSE

503504 - Economics of Natural Resources and Environmental Policy **Credits, ECTS:** 6

## COURSE DESCRIPTION

"Economics of Natural Resources and Environmental Policy" is an elective subject (6 ECTS) of the Master in Economics: Economic Analysis Tools. This one year Master program (60 ECTS) extends over three trimesters and is jointly offered by the Universities of Cantabria, Oviedo and the UPV/EHU. This subject, being elective, is taught only at the UPV/EHU, being the students who move to take it. For this reason, teaching is concentrated in one day, on Wednesdays during the 9 weeks of the second trimester.
The main objective of this course is to explain how natural resources such as fishery resources, forest resources or non-renewable resources are managed / should be managed.
Regardless of the initial training of the master's students, the basic concepts for this subject are covered in the compulsory subjects of the Master. Additionally, the introductory topic will deepen into certain mathematical and computational tools that will be used extensively in this subject: the analysis of the qualitative behavior of discrete dynamic systems and dynamic optimization in discrete time.
In turn, this subject provides basic concepts for other elective subjects of the Master that are offered in the second and third trimesters such as: "Regulation and Competition Policy", "Analysis of Public Decisions" and "Evaluation of Transport and Network Policies "
The development of the subject is proposed according to the double track of the Master: professional and research oriented. Thus, the course presents the student with a range of tools of economic analysis for the solution of natural resource management problems that will be of interest to both collaborating companies and institutions, where they can carry out placements, and to carry out a research project (Master Thesis) that may lead to the future completion of a Doctoral Thesis.

In addition to the specific competences of the subject collected in the memory of the degree, throughout the course the following transversal competences are worked:
CT1692- Managing information and communication technologies in professional and research activities in the field of economic analysis.

CT1702 - Planning tasks, organizing resources and efficiently managing time.

CT1709- Identifying and solving specific problems developing the capacity for analysis and synthesis.

CT1711- Communicating fluently, both orally and in writing in Spanish, as well as reading, understanding and writing texts in English.

The learning results of the subject are the following:

R1- To have a basic knowledge of natural resource economics.
R2- To know and understand the economic models used to study natural resource management problems.
R3- To apply the economic models studied to specific natural resource management problems (local, regional or international).
R4- To plan tasks properly and efficiently manage time.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocer los principios del análisis económico más relevante en la gestión óptima de los recursos naturales, teniendo en cuenta que la incertidumbre y la irreversibilidad juegan un papel muy importante.
Analizar el comportamiento de los mercados y de los agentes económicos para la correcta modelización de los problemas ambientales.
Identificar los objetivos y los requisitos que deben satisfacer las políticas medioambientales cuya finalidad sea la utilización eficiente de los activos ambientales y el desarrollo sostenible.
Conocer de forma precisa la legislación vigente, los acuerdos internacionales y la actuación de los organismos públicos en materia medioambiental.
Realizar labores de estudio, asesoramiento y diseño de políticas medioambientales que garanticen el desarrollo sostenible.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

The introductory topic covers (1) the main methods of qualitative analysis of the behavior of discrete dynamic systems, (2) some methods for dynamic discrete time optimization and (3) the use of Excel, and specifically some routines such as "Solver", to carry out optimization and simulation exercises. The aim of the introductory topic is to get acquainted with the most basic mathematical and computational instruments that allow operating, through very simple numerical problems, the most common theoretical concepts in Natural Resource Economics and build bridges towards the empirical analysis of this type of problems.
The second topic focuses in the economic theory that underlies the optimal exploitation of fishery resources. It starts analyzing separately the biological aspects (dynamics of fishing stocks) and the economic aspects (fishery production functions) of a fishery. Next, the overexploitation that occurs in fisheries exploited under an open-access regime is analyzed, both through a static and a dynamic model. Subsequently, open - access exploitation levels are compared with those that are produce in a context where property regimes are well defined and this is also analysed in both an static and a dynamic context. Finally, different fisheries management policies proposed in the literature are analyzed, with special emphasis on total allowable catches, individual transferable quotas and marine reserves.
The third topic analyzes another renewable resource, forests, whose management has some interesting peculiarities. As with other renewable resources, optimal forest management will result from the combination of information from biological origin and certain economic variables. Therefore, the topic begins by analyzing the functions of forest resource growth (volume of marketable wood), to later incorporate economic variables (prices, costs and discount rates) in order to define optimal forest rotation in two contexts: a single rotation or an indefinite succession of rotations. Finally, a link is established with the following topic, that of the non-renewable resources, analyzing the determination of the optimal stock of natural forests (old growth forests).
The fourth and final topic analyzes how to exploit resources that are not renewed on a time scale of economic relevance. It aims at answering the following questions: What is the proper rate of extraction of a non-renewable resource? It is always optimal to exhaust a non-renewable resource? Can it ever be optimal to leave a field of non-renewable resources with positive reserves? Is the rate of exploitation of a renewable resource different when exploiting it under a regime of perfect competition instead of doing it under a monopoly? If you can increase the resource base to exploit through the search for new reserves, what is the right investment in searching for these new reserves? Finally, the appropriate measure of scarcity of non-renewable resources is discussed.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Theory | 5 | 100 % |
| Seminars | 15 | 33 % |
| Classroom practicals | 45 | 44 % |
| Lectures | 85 | 35 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 30 | 5 | 10 | | 10 | | | 5 | |
| Horas de Actividad No Presencial del Alumno/a | 50 | 10 | 10 | | 20 | | | 0 | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 50 % | 70 % |
| Presentations | 10 % | 30 % |
| Questions to discuss | 10 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Class attendance guarantees that the evaluation of the subject can be a continuous evaluation based on:

(i) individual tasks, and
(ii) oral presentation of an individual work.

If a student does not pass the subject through this continuous assessment system, they may choose a final exam, which will consist of a written test with exercises to solve and questions to be developed related to the topics of the program and the required readings.

To renounce the ordinary call, it will be enough not to sit the final exam and it will be reflected in the Transcript of Records

as NOT PRESENTED.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary call will consist of a written test with exercises to solve and questions to be developed related to the topics of the program and the compulsory readings. This test will be 100% of the grade and will take place on the date set in the official exam calendar.

To renounce the extraordinary call, it will be enough not to sit the exam. It will be reflected in the Transcript of Records as NOT PRESENTED.

## MANDATORY MATERIALS

Conrad, J.M. (2010), "Resource Economics" (Second Edition), Cambridge University Press.

Conrad, J.M. and C.W. Clark (1987), "Natural Resource Economics: Notes and Problems", Cambridge University Press.

Perman, R. , Y. Ma, J. McGilvray and M. Common (2003), ¿Natural Resource and Environmental Economics¿ (Third Edition), Pearson Education-Addison Wesley.

Riera, P., D. García, B. Kriström y R. Brännlund (2005), ¿Manual de Economía Ambiental y de los Recursos Naturales¿, Thomson.

## BIBLIOGRAFÍA

### Basic bibliography

Bárcena- Ruiz J. C. and Garzón M. B., (2003). Strategic Environmental Standards, Wage Incomes and the Location of Polluting Firms. Environmental and Resource Economics 24, 121-139.
Bárcena-Ruiz J. C., (2006). Environmental Taxes and First-mover Advantages. Environmental and Resource Economics, forthcoming.
Conrad, J.M. y C.W. Clark (1994), ¿Natural resource economics: Notes and problems¿, Cambridge University Press, Cambridge.
Meadows, D.; Randers, J., Meadows, D. 2005. Limits to Growth. The 30-years update. Earthscan, London. 338 pp.
Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-Being, a framework for assessment. Island Press, 245 pp.
European Environment Agency, (2000). Environmental Taxes: Recent Developments in Tools for Integration. Environmental Issues Series Nº 18.
Kennedy, P., (1994). Equilibrium Pollution Taxes in Open Economies with Imperfect Competition. Journal of Environmental Economics and Management 27, 49-63.
Ulph, A., (1996). Environmental Policy and International Trade when Governments and Producers Act Strategically. Journal of Environmental Economics and Management 30, 256-281.
Perman, R., Y. Ma, J. McGilvray y Michael Common: ¿Natural Resource and Environmental Economics¿, Pearson Education-Addison Wesley, 3rd edition 2003.

### Detailed bibliography

Azqueta, D. y A. Ferreiro (eds), ¿Análisis económico y gestión de recursos naturales¿, Alianza Editorial, Madrid, 1994.
Baumol W. J. y W. E. Oates, ¿The Theory of environmental policy¿, Cambridge University Press, 1988..
Hartwick, J.M. y N. Olewiler, ¿The Economics of Natural Resource Use¿, segunda edición, Addison-Wesley Longman Ltd, New York, 1997.
Haab T. y K.E. McConnell, ¿Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation¿.
P. Riera, D. García, B. Kriström y R. Bränlund. ¿Manual de Economía Ambiental y de los Recursos Naturales¿, Thomson Editores, 2005.
Stavins Robert N. (ed.), ¿Economics of the Environment. Selected Readings¿, W.W. Norton and Company, 5ª ed., 2005.

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 321 - Faculty of Economics and Business | **Cycle** Not Applicable

**Degree** ECONO802 - Master in Economics: Economic Analysis Tools | **Year** Not Applicable

## COURSE

503506 - Game Theory | **Credits, ECTS:** 3

## COURSE DESCRIPTION

The course of Game Theory consists of an introduction to both Game Theory as well as an introduction to Experimental Economics and Behavioral Economics.
The first part of the course focuses on the core concepts of Game Theory (both cooperative and non-cooperative): definition of a game in normal and extensive-form, coalitions and different solution concepts.
The second part of the course focuses on revising the core assumptions made in Microeconomic Theory and Game Theory in light of empirical evidence gathered using experimental methods.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocer los principios del análisis económico más relevante en la gestión óptima de los recursos naturales, teniendo en cuenta que la incertidumbre y la irreversibilidad juegan un papel muy importante.
Analizar el comportamiento de los mercados y de los agentes económicos para la correcta modelización de los problemas ambientales.
Identificar los objetivos y los requisitos que deben satisfacer las políticas medioambientales cuya finalidad sea la utilización eficiente de los activos ambientales y el desarrollo sostenible.
Analizar el comportamiento de los agentes económicos en la toma de decisiones con el fin de entender cómo funcionan los mercados, especialmente en condiciones de competencia e información imperfecta.
Comprender el papel de las instituciones públicas en la economía industrial, tanto desde la perspectiva de la regulación de mercados como de la implementación de políticas microeconómicas.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Core concepts in the definition of strategic environments: games, players, actions and strategies, information sets and order in decision making, and finally, payoffs.
Core concepts in the definition of a cooperative game: players, coalitions, characteristic function, axioms.
Core concepts and their assumptions in different solution concepts: Nash equilibrium, rationalizability, subgame perfect Nash equilibrium, Bayesian Nash equilibrium, core, Shapley value, stability.
Core concepts in the use of experimental methods: randomized experiments, subjects, recruitment, treatments, incentives, instructions.
Main findings of behavioral and experimental economics regarding social preferences and non- equilibrium play.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Theory | 5 | 100 % |
| Seminars | 7 | 0 % |
| Computer practicals | 8 | 0 % |
| Classroom practicals | 15 | 66 % |
| Lectures | 40 | 37 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 0 | 10 | | 0 | | | 5 | |
| Horas de Actividad No Presencial del Alumno/a | 25 | 7 | 5 | | 8 | | | 0 | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|

| | | |
|---|---|---|
| Written examination | 50 % | 70 % |
| Presentations | 10 % | 30 % |
| Questions to discuss | 10 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

La evaluación consistirá en un examen final que contará el 100% de la nota final.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

La evaluación consistirá en un examen final que contará el 100% de la nota final.

## MANDATORY MATERIALS

Todo el material necesario será impartido en las notas de clase así como en las transparencias utilizadas durante las clases magistrales.

## BIBLIOGRAFÍA

### Basic bibliography

Aumann R. J.: Nash equilibria are not self-enforcing, Economic decision making: Games, econometrics and optimization. North-Holland, 1990.
Gibbons, R. (1993): Un primer curso de teoría de juegos, Antoni Bosch Editor.
Kreps, D. (1995): Curso de Teoría Microeconómica, McGraw-Hill.
Binmore, K. (1994): Teoría de Juegos, McGraw-Hill.

Gardner R (1996): Juegos para empresarios y economistas, Antoni Bosch editor.

Rasmusen, E. (1996): Juegos e información. Una introducción a la teoría de los juegos. Fondo de cultura económica. Mexico. Primera edición en inglés, 1989, Basil Blackwell, Cambridge, Massachussets y Oxford.

Tirole, J. (1990): La teoría de la Organización Industrial. Ariel Economía.

### Detailed bibliography

Binmore, K. (1994): ¿Teoría de Juegos¿, McGraw-Hill.
Gardner R (1996): ¿Juegos para empresarios y economistas¿, Antoni Bosch editor.
Rasmusen, E. (1996): ¿Juegos e información. Una introducción a la teoría de los juegos¿. Fondo de cultura económica. Mexico. Primera edición en inglés, 1989, Basil Blackwell, Cambridge, Massachussets y Oxford.
Tirole, J. (1990): ¿La teoría de la Organización Industrial¿, capítulo 11. Ariel Economía.

### Journals

### Web sites of interest

https://www.coursera.org/course/gametheory
http://www.springerlink.com/content/101791/
http://www.sapub.org/journal/aimsandscope.aspx?journalid=1021

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao

**Cycle** Not Applicable

**Degree** CITEC401 - Master in Space Science and Technology

**Year** Not Applicable

## COURSE

501990 - Space Physics

**Credits, ECTS:** 3

## COURSE DESCRIPTION

Contrary to popular belief, space is a place full of activity. Although the density of matter is very low, we have a plasma consisting of charged particles of very different energies. The behavior of this plasma is influenced by the variable behavior of the sun's magnetic field, which in turn is also the main source of charged particles, emitted in what is known as the solar wind. The interaction of this complex system of particles and fields with the Earth's magnetic field gives rise to the appearance of radiation belts and auroras.

The enormous amount of energy released by the sun in the form of radiation and particles can damage and even destroy satellites, and it affects life very seriously, limiting the possibilities of space travel. Knowledge of the properties of the space environment is therefore essential in the development of any space program, and must be part of any space science and technology program.

As a compulsory subject, Space Physics will be taught in the first term. The subject is related and reinforce contents taught in other compulsory subjects, such as Orbital Movement (different orbits cross different space environments) and Spaceships II (in relation to the peculiarities of the propagation of the EM waves in the space environment and communication problems related to disturbances in this environment). The subject provides a basis for the study of elective subjects such as Astronomy and Astrophysics, Solar System, and from a more technological point of view, Materials for space II.

The prerequisites for this course are a basic knowledge of electromagnetism and calculus including differential equations. These prerequisites are guaranteed by the required undergraduate qualifications.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocer las propiedades físicas del medio espacial relacionándolas con las implicaciones que este medio impone en los programas de desarrollo espacial.
.- Ser capaz de deducir propiedades cuantitativas del comportamiento de los plasmas espaciales y de sus interacciones con los objetos situados en el espacio.
Ser capaz de analizar, trabajando en equipo con personas de distinta formación, los distintos aspectos de la influencia del medio espacial en un proyecto, comunicando de forma eficaz las competencias de su propia especialidad a otros miembro del equipo.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

At the end of the course the student should be able to:

<ol>

<li> Define a plasma and the most important parameters that define its behavior.</li>

<li> Describe the basic characteristics of the solar atmosphere, the solar cycle, the solar wind and the Earth's magnetosphere.</li>

<li> Explain through physical models some of these characteristics (for example, the position of the magnetopause, the direction of the interplanetary magnetic field, the temperature of sunspots...)</li>

<li> Know the different types of waves that propagate in the interplanetary medium and their basic properties.</li>

<li> Describe the different Space Weather phenomena of technological relevance.</li>

<li> Know some information databases about the space environment and the Space Weather prediction portals.</li>

<li> Know different packages of models frequently used in the study of the spatial environment. </li></ol>

## CONTENIDOS TEÓRICO-PRÁCTICOS

<ol>
<li> Introduction to the space environment. </li>

 Part I: Plasma Theory 

<li> Electromagnetism. Review of concepts. </li>
<li> Physics of Plasmas. </li>
<li> Magnetohydrodynamics. </li>
<li> Movement of charged particles in electromagnetic fields. </li>
<li> Waves in plasmas </li>
 Part II: The space environment 

<li> The sun: Interior and atmosphere. Variable activity in the sun .. </li>
<li> The solar wind and the interplanetary magnetic field </li>
<li> The Earth's magnetosphere </li>
<li> The ionosphere </li>
<li> Influence of solar activity on the magnetosphere: Magnetic storms </li>
<li> Space weather. Current status and technological impact </li> </ol>

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Utilization of Computer Programs | 2 | 50 % |
| Individual work and/or group work | 10 | 40 % |
| Exercises | 28 | 36 % |
| Expositive classes | 35 | 43 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 4 | 10 | | 1 | | | | |
| Horas de Actividad No Presencial del Alumno/a | 20 | 6 | 18 | | 1 | | | | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Essay, Individual work and/or group work | 30 % | 30 % |
| Exhibition of work, readings... | 10 % | 10 % |
| Written/oral tests | 10 % | 10 % |
| Realización de prácticas (ejercicios, casos o problemas) | 50 % | 50 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Assessment tools and percentages
<ol>
<li>Problems: 50% of the final grade. There will be three hand-outs consisting of a set of problems that will be marked and returned to the students. The correct solutions will be published in EGELA as feedback. The grading of problems will take into account whether the answers are correct (when they are closed answers) or the depth of the analysis (when they are open answers). In addition, precision of notation, adequate use of physical laws and correct use of units and significant figures will be valued.</li>

<li>Minitests: 10% of the final grade. The minitests will consist of a short question related to content of previous lectures and hand-outs. They will be answered individually in approximately 10 minutes during lectures.</li>

<li>Essay: 30% of the final grade. They will be assessed taking into account the rigor and quality of writing, its adjustment to the contents of the subject, and the correct reference to used sources.
Failure to comply with formal requirements, particularly those related to essay length, will lower the final grading.
Plagiarism will be penalized with a no pass.</li>

<li>Oral presentation of the essay: 10% of the final grade. It will be assessed taking into account the quality of the support material, the precision of speach and correct body language. Very long or very short presentations will be penalized.</li>

No-show

People who do not submit at least two of the three problem sets and / or do not present the essay will be considered as "no show" in the ordinary call.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

To pass the subject in the extraordinary call, the students will have to present the problem sets and a written essay. They will also be offered the possibility of taking a short exam to improve the grading of the mini-tests.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

<li> Understanding Space Weather and the Physics Behind it, D.d. Knipp, McGraw Hill 2011</li>
<li>Space Physics - An Introduction, C.T. Russell; J.G. Luhmann, R.J. Strangeway, Cambridge University Press 2016</li>
<li>Planetary Sciences, 2nd Edition, I. de Patter y J.J. Lissauer, Cambridge University Press 2010</li>
<li>Basic Space Plasma Physics, W. Baumjohan y R.A. Treumann, Imperial College Press 1997</li>
<li> Space Weather, environment and societies, J.Lilensten J.Bornarel, Springer</li>

### Detailed bibliography

<li>Space Physics, 3rd Edition, M-B Kallenrode, Springer,2003</li>
<li>Physics of the Earth¿s Space Environment. Gerd W. Prölss, Springer, 2003</li>
<li>Physics of the Solar System Plasmas, T.E. Cravens, Cambridge University Press1997</li>
<li> Physics of the Space Enviroment, T.I. Gombosi, Cambridge University Press 2004</li>
<li> The Space Enviroment, A.C. Tribble, Princeton University Press 2003</li>

### Journals

### Web sites of interest

Space Weather:
<li>http://www.swpc.noaa.gov/ </li>
<li>http://www.esa-spaceweather.net/spweather/current_sw/index.html </li>
<li>http://sohowww.nascom.nasa.gov/spaceweather/ </li>
<li>http://spaceweather.com/ </li>

A few relevant missions 
<li>SDO http://sdo.gsfc.nasa.gov/ </li>
<li>SOHO http://sohowww.nascom.nasa.gov/ </li>
<li>STEREO http://www.nasa.gov/mission_pages/stereo/main/index.html </li>
<li>TRACE http://trace.lmsal.com/ </li>
<li>HINODE http://solarb.msfc.nasa.gov/ </li>
<li>ULYSSES http://ulysses.jpl.nasa.gov/ </li>

Summary of NASA and ESA missions
<li> http://www.nasa.gov/missions/past/index.html</li>
<li> http://orbits.esa.int/science/index.htm</li>

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao **Cycle** Not Applicable

**Degree** CITEC401 - Master in Space Science and Technology **Year** Not Applicable

## COURSE

501994 - Space Materials I: Fundamentals **Credits, ECTS:** 3

## COURSE DESCRIPTION

This course presents the fundamentals of the internal structure of materials and their relationship with their properties, emphasizing the materials used in space technology. These fundamentals will be useful in subjects of later courses such as "Space Mechanical Structures", "Non Destructive Testing: Space Materials", "Materials for Space: II. Applications" and "Detectors and Sensors".

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Que el estudiante posea conocimientos bien fundamentados sobre los mecanismos de propagación del calor y sobre las propiedades térmicas de materiales que se utilizan en la tecnología espacial.
Que el estudiante sea capaz de resolver ordenada y justificadamente problemas complejos relacionados con las propiedades térmicas de materiales y con el transporte del calor.
Que el estudiante se capaz de realizar eficazmente tareas de medición de propiedades térmicas de materiales espaciales a bajas y a altas temperaturas.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

The learning outcomes that students are expected to achieve by the end of the subject are:
- Demonstrate detailed understanding of the basic concepts related to Material Science and Technology, as well as their application for the reasoned resolution of problems related to space technology.
- Mastery of instrumentation related to the measurement of thermal properties of all types of materials.

## CONTENIDOS TEÓRICO-PRÁCTICOS

1.- Materials for space: metal alloys, ceramics and composites
2.- Heat diffusion mechanisms: conduction, convection and radiation
3.- Thermal properties of space materials: conductivity, specific heat, thermal expansion
4.- Thermal properties at low temperatures: cryogenics
5.- Thermal properties at high temperatures: furnaces

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Laboratory/Field | 10 | 50 % |
| Exercises | 25 | 40 % |
| Expositive classes | 40 | 38 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | | 10 | 5 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 25 | | 15 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Solving practical cases | 50 % | 50 % |
| Realización de prácticas (ejercicios, casos o problemas) | 50 % | 50 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In order for the students to achieve the learning results, they must correctly carry out the exercises/tests proposed throughout the course. These exercises will be scored out of 10 and their average will be the resulting mark for the course. To pass the subject it will be necessary to obtain at least a 5.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A single examination will be carried out in order to measure the learning achievements of the student. To pass the subject it will be necessary to obtain at least a 5.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

- "Fundamental University Physics: Quantum and Statistical Physics Volume III", N. Alonso, E.J. Finn
- "Physics for Scientists and Engineers" P.A. Tipler, G. Mosca, 6th Ed
- "Materials Science and Engineering: An Introduction" W.D. Callister Jr., D.G. Rethwisch, 10th Edition
- "The Feynman Lectures on Physics" R.P. Feynman; M. Sands , Ed. Basic Books
- "Foundations of Materials Science and Engineering" W.F. Smith,  J. Hashemi  Mc Graw Hill. 7th Ed, 2022

### Detailed bibliography

- "Principles of Materials Sience and Engineering" William F. Smith, Mcgraw-Hill 1986
- "Transferencia De Calor", Yunus A. Cengel, Macgraw-Hill, 2004
- "Heat Conduction",  M. Necati Özisik, John Wiley & Sons, 1980

### Journals

- International Journal of Thermophysics
- International Journal of Heat Transfer
- Infrared Physics and Technology

### Web sites of interest

European Space Agency Website: http://www.esa.int/esaCP/Spain.html
NASA Website: http://www.nasa.gov

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable

**Degree** CITEC401 - Master in Space Science and Technology
**Year** Not Applicable

## COURSE

502005 - Space Interferometry
**Credits, ECTS:** 3

## COURSE DESCRIPTION

This course develops the main theoretical and practical knowledge of interferometry applied to Space Science and Technology that allows the resolution of problems and the development of real projects in the field. The course is related to the mandatory subjects of Basis of Optic Instrumentation, Detectors & Sensors and Space Data Processing, as it makes use of a wide rage of concepts and tools developed in those subjects. The course is also related with the optional course of Optic System Design and Adaptative Optics, as the knowledge taught in optics is also used in interferometry technologies.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Que los estudiantes adquieran conocimientos de los aspectos básicos y teóricos de la interferometría, con especial énfasis en el concepto de coherencia.
Que los estudiantes sepan identificar y analizar los componentes constituyentes de interferómetros básicos.
Que los estudiantes sean capaces de resolver ordenada y justificadamente problemas aplicados a interferometría.
Que los estudiantes posean conocimientos de las técnicas, métodos y sistemas empleados en interferometría estelar.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

The learning outcomes that students are expected to achieve at the end of the semester are:
To acquire knowledge of the basic and theoretical aspects of interferometry, with emphasis on the concept of coherence.
To identify and analyze the constituent components of basic interferometers.
To be able to resolve in an orderly and justified manner, problems applied to interferometry.
To possess basic knowledge of the techniques, methods and systems used in space interferometry.

## CONTENIDOS TEÓRICO-PRÁCTICOS

UNIT 1: INTRODUCTION TO SPACE INTERFEROMETRY
UNIT 2: FOUNDAMENTS OF SPACE INTERFEROMETRY
UNIT 3: IMAGE FORMATION
UNIT 4: OPTICAL EFFECTS OF THE ATMOSPHERE
UNIT 5: INSTRUMENTAL TECHNIQUES
UNIT 6: INTERFEROMERY OBSERVATION PLANNING

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Laboratory/Field | 10 | 100 % |
| Exercises | 20 | 50 % |
| Preparation of works | 20 | 0 % |
| Expositive classes | 25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 18 | 2 | 10 | | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 30 | 0 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

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

- Mid-term tests consisting on problem resolutions:
The following will be valued: The knowledge degree of the basic principles of interferometry, the precision in the use of arguments, the obtention of exact numerical values, the completeness of the solutions, the correct use of the verbal, mathematical and/or graphical language. The serious conceptual errors will be penalized.
- Evaluation of laboratory reports. The students must hand in 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 grade will be calculated according to the following percentages:
Midterm exam marks: 40%
Practice report marks: 60%.
It is a necessary condition to pass the course to have passed the practices and to have obtained an overall mark equal to or greater than 5.
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 tehvea luaticoono rrdeinsspayotosnrtseimbl e must present for the subject a waiver of continuous evaluation in written form, for which they will have a period of 9 weeks, starting from the beginning of the semester. In this case, the learning outcomes will be evaluated through a test, consisting of:
-A final written 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 Interferometry, 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 graphic language. Serious conceptual errors will be penalized in the correction.
must contain: obtaining and mathematical treatment and graphing of experimental data, calculation of errors, discussion of results and the conclusions of the work.
The final mark will be calculated according to the following percentages:
Written exam mark: 40%
Practice report marks: 60%
It is a necessary condition to pass the course to have passed the practices and to have obtained an overall mark equal to or greater than 5.
In the case of the final evaluation, the no attendance to any exam will entail the automatic waiver of the evaluation call and will appear as Not Presented.

## 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 Interferometry, 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 graphic language. Serious conceptual errors will be penalized in the correction.
-A practical exam that will be carried out in the laboratory. In this exam, the students 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 the conclusions of the work.
The final mark will be calculated according to the following percentages:
Written exam mark: 40%
Practice report marks: 60%
It is a necessary condition to pass the course to have passed the practices and to have obtained an overall mark equal to or greater than 5.
In the case of the final evaluation, the no attendance to any exam will entail the automatic waiver of the evaluation call and will appear as Not Presented.

## MANDATORY MATERIALS

[1] E. Hecht, Optics, 4th Ed. , Addison-Wesley, 2001.
[2] M. Born, E. Wolf, Principles of Optics, 6th Ed., Pergamon Press, 1990 (New York).

## BIBLIOGRAFÍA

### Basic bibliography

• Optics, E. Hecht, 5th Ed., Pearson, 2017.
• Principles of Optics, M. Born and E. Wolf. 7th Ed., Cambridge University Press, 2000.
Introduction to Optics, F.L. Pedrotti, L.M. Pedrotti and L.S. Pedrotti, 3rd Ed., Pearson Education, 2014.
Bibliografía para las prácticas de laboratorio
• "A daylight experiment for teaching stellar interferometry." M. A. Illarramendi, R. Hueso, J. Zubia, G. Aldabaldetreku, G. Durana, and A. Sánchez-Lavega. American Journal of Physics 82, 649 (2014).
• "Interferometry of binary stars using polymer optical fibres", L. Arregui, M. A. Illarramendi, J. Zubia, R. Hueso and A. Sánchez-Lavega. European Journal of Physics, 38, 045704 (2017).
• "Teaching stellar interferometry with polymer optical fibers", M. A. Illarramendi, L. Arregui, J. Zubia, R. Hueso and A. Sánchez[ ]Lavega. Proceedings Volume 10452, 14th Conference on Education and Training in Optics and Photonics: ETOP 2017; 1045216 (2017)
• "Adaption of the Michelson interferometer for a better understanding of the temporal coherence in lasers", M. A. Illarramendi, J. Zubia, J. Arrue and I. Ayesta.Proceedings Volume 10452, 14th Conference on Education and Training in Optics and Photonics: ETOP 2017; 1045249 (2017)

### Detailed bibliography

[1] P. Hariharan, optical interferometry, 2nd ed., Academic Press, 2003 (san diego).
[2] E. Wolf, Introduction to the theory of coherence and polarization of light, 1st ed., Cambridge University Press, 2007.
[3] A. R. Thompson, J. M. Moran, G. W. Swenson jr., Interferometry and synthesis in radio astronomy, 2nd ed., John Wiley & Sons, 2001.
[4] Joseph W. Goodman, Statistical optics, 1st ed., John Wiley & sons, 1985.
[5] J. D. Monnier, Optical Interferometry in Astronomy, Reports on Progress in Physics, vol. 66, pp. 789-857, 2003.

### Journals

- American Journal of Physics
- European Journal of Physics
- European Journal of Engineering Education

### Web sites of interest

- Tutorials European Southern Observatory
https://www.eso.org/sci/facilities/paranal/telescopes/vlti/tuto.html

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable

**Degree** CITEC401 - Master in Space Science and Technology
**Year** Not Applicable

## COURSE

502006 - Astronomy and Astrophysics
**Credits, ECTS:** 3

## COURSE DESCRIPTION

This course provides a theoretical and practical scientific background to the physical processes operating in the Universe at very different scales (interstellar, intergalactic and cosmological scales).

This knowledge is required for both a scientific carrer and for the implementation of technological projects in the field of Space Sciences.

A basic knowledge of the celestial coordinate systems and of the apparent movement of the stars is also very important for telemetry and positioning technologies.

We also intend to provide the students familiarity with the astronomical instrumentation and the most common astrophysical techniques.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Adquirir conocimientos científicos sobre Astronomía y Astrofísica que aporten un contexto a aplicaciones tecnológicos o al desarrollo de una carrera investigadora.
Conocer y manejar con soltura la instrumentación y el software astronómico elemental, así como el procesado básico de datos astronómicos.
Desarrollar la capacidad de resolver los problemas asociados a la necesidad de obtener una serie determinada de datos científicos, estableciendo las estrategias metodológicas e instrumentales adecuadas.
Adquirir experiencia básica en la realización de una tarea científica y técnica en equipo asumiendo los roles adecuados para cada uno de los miembros y estableciendo una cadena de trabajo productiva.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. Astrophysics Foundations: Introduction. History of the Astronomy. Fundamentals.
2. Observational Astronomy: Celestial coordinates. Time account. Astronomical instrumentation.
3. Stellar Astrophisics I: Stellar parameters determination. HR Diagram. The Sun as a normal star.
4. Stellar Astrophysics II: Stellar atmospheres and interiors. Stellar formation. Stellar evolution.
5. Interstellar medium and Galactic Astrophysics: Interstellar medium. Stellar clusters. The Milky Way.
6. Extra-galactic Astrophysics and Cosmology: Galaxies. Extra-galactic Astrophysics. Cosmology Foundations.
7. Experimental techniques on Astrophysics: Night-sky orientation. Databases: SIMBAD and VO. Telescope control. Observation techniques: imaging and photometry, long-slit spectroscopy. Astronomical data processing using MATLAB.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Exercises | 20 | 25 % |
| Laboratory/Field | 20 | 25 % |
| Expositive classes | 35 | 57 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | | 5 | 10 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 15 | | 15 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The course will be evaluated through four problem lists given by the teacher. These will be proposed at the end of the topics 2, 4 and 6 and at the end of the course for the astrophysical techniques.

The students are allowed to opt for a final written exam at the end of the course covering all the topics in the program.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The students are evaluated with a final written exam covering all the topics in the program.

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

B.W. Carroll, D.A. Ostlie. An Introduction to Modern Astrophysics. Pearson (2008).
H. Karttunen, P. Kröger, H. Oja, M. Poutanen, M. J. Donner, Fundamental Astronomy, Springer-Verlag (Heidelberg), 3ª edición (1996).
S. Green, M.H. Jones, An Introduction to the Sun and Stars, Cambridge (2003).
M.H. Jones, R. Lambourne, M.H. Jones, R. Lambourne, An Introduction to Galaxies and Cosmology Introduction to Galaxies and Cosmology, Cambridge , Cambridge (2003).
A. Unsöld, The New Cosmos, Springer-Verlag (Heidelberg), (1977).
M. L. Kutner. Astronomy, a physical perspective. Cambridge University Press (2003).

### Detailed bibliography

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable

**Degree** ININD902 - Master in Industrial Engineering
**Year** Second year

## COURSE

503302 - Design and Product Development
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

Product Design and Development.

The main objectives of the course are:
- To understand the process of design and development of an industrial product.
- To learn, using current tools and methods, applying and sharing existing knowledge, developing group work and improving communication skills.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Knowledge and ability to project, design and develop industrial products.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

They are specified in:
- Knowledge and ability to project and design industrial products.
- Knowledge of product design methodologies according to its life cycle.

The student who passes the course should be able to:
- Generate conceptual designs and develop the technical specifications of industrial products.
- Design product models in a concurrent engineering environment.
- Manage the product design and development process, taking into account its life cycle, in a collaborative engineering environment.

## CONTENIDOS TEÓRICO-PRÁCTICOS

The fundamental theoretical contents correspond to the stages of a generic process of design and development of an industrial product:

- Nature of the design of new products.
- Stages and methods of the design process.
- Needs and technical specifications.
- Generation of conceptual solutions.
- Concept testing.
- Comparison and selection of alternatives.
- Ergonomic and aesthetic aspects.
- Materials and manufacturing processes.
- Environmental criteria.
- Design process management.
- Integrated industrial design project in a collaborative environment.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Lectures | 37,5 | 40 % |
| Laboratory practicals | 75 | 40 % |

## 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Attendance and participation | 10 % | 30 % |
| Written examination | 5 % | 50 % |
| Presentations | 10 % | 15 % |
| Practical tasks | 20 % | 65 % |
| Questions to discuss | 5 % | 15 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A good performance in the course reflected in the collaborative work, carried out sequentially throughout the four-month period, and its final defense, together with the complementary exercises developed in class, may mean that the final exam is unnecessary or has little weight. The student who dispenses with the follow-up of the course will always be able to take the final exam, in this case, with a weight of 100%.

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 students will be promptly informed.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

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 students will be promptly informed.

## MANDATORY MATERIALS

The use of the materials provided in the eGela is recommended.

## BIBLIOGRAFÍA

### Basic bibliography

- Product Design and Development. < K.T. Ulrich and S.D. Eppinger >
- El Proceso de Diseño en Ingeniería. < C.L. Dym and P. Little >.
- Engineering Design Methods. < Nigel Cross >.
- Metodología del Diseño Industrial. < M. García; V. Cloquell; T. Gómez >
- The Mechanical Design Process. < David G. Ullman >
- Diseño Industrial. Desarrollo de Producto. < F. Sanz y J. Lafargue >.
- Metodología del Diseño Industrial. < F. Aguayo y V.M. Soltero >
- Manual práctico de Ecodiseño. Operativa de Implantación en 7 pasos. < IHOBE >
- Breve Historia del Diseño Industrial. < J. Heskett >.
- Diseño Industrial I y II. <Danielle Quarante>.

The following book is highly recommended:
- Product Design and Development. < K.T. Ulrich and S.D. Eppinger >, whose fifth edition is translated into Spanish.

### Detailed bibliography

- ¿Cómo nacen los objetos? Apuntes para un metodología proyectual < Bruno Munari >.
- Diseño. Historia, teoría y práctica del diseño industrial. < B.E. Bürdek >
- Estrategias para la Creatividad. <G.A. Davis and J.A. Scott>.
- El Diseño Tridimensional. Del Boceto a la Pantalla. <Alan Pipes>.
- Color. <Frans Gerritsen>.
- Ergonomía. <Mc. Cormick, Ernest>.
- Las Dimensiones Humanas en los Espacios Interiores. < J. Panero y M. Zelnik >.
- Materials Selection in Mechanical Design. < Michael F. Ashby >
- Plastic Part Design for Injection Molding. < Robert A. Malloy >
- Ingeniería de Diseño (I, II y III). < P. Orlov >.
- Diseño en Ingeniería Mecánica. < J.E. Shigley and C.R. Mischke >.
- Historia del Diseño Industrial. < R. Torrent y J.M. Marín >.

(*) The books in this category can be used occasionally as a complement in some subjects.

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** ININD902 - Master in Industrial Engineering
**Year** First year

## COURSE

503905 - Integrated Manufacturing Systems
**Credits, ECTS:** 3

## COURSE DESCRIPTION

The subject "Integrated Manufacturing Systems" is taught in the 1st Course of the Master's Degree in Mechanical Engineering and is the only compulsory subject directly related to processes and technologies for mechanical manufacturing.
The subject focuses on the study of manufacturing systems from the point of view of their necessary interaction with mechanical manufacturing processes. After having studied the fundamental description of the processes in the Degree of Industrial Technologies, the student is in a position to analyze the equipment, machinery and tools, as well as the technology necessary for the manufacture of a component. It is a subject that contributes fundamentally to the acquisition of the competences related to project, calculate and design integrated manufacturing and dimensional control systems.
The subject has been designed in a way that integrates and interacts with subjects related to materials, calculation of machine elements and production automation. On the other hand, the subject prepares the student to address, if he/she wishes to configure his/her curriculum, the proposed intensifications of Product Design and Manufacturing, and of Mechanical Design. Their programs have been coordinated with the contents of Integrated Manufacturing Systems.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

SLC ¿ Knowledge and ability to project, calculate and design integrated manufacturing systems.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

RA-1 A deep knowledge and understanding of the principles of their specialty.
RA-2 Critical awareness of the vanguard knowledge of their specialty.
RA-3 The ability to solve problems outside the standard guidelines of their engineering branch, defined incompletely or with inconsistent specifications.
RA-4 The ability to formulate and solve problems in new emerging areas of their specialty.
RA-5 The ability to use their knowledge and sufficient understanding to conceive models, systems and engineering processes.
RA-6 The ability to identify, find and obtain data.
RA-7 The ability to design and carry out research based on analysis, modeling and experimental data.
RA-8 The ability to critically analyze the data and reach conclusions.
RA-9 The ability to investigate the application of new technologies in its engineering branch.
RA-10 The ability to use their knowledge and understanding to provide solutions to problems that require knowledge beyond those of their discipline.
RA-11 The creative capacity to develop new and original ideas and methods.
RA-12 The ability to use its technical sense to work with incomplete and complex information; and with technical uncertainty.
RA-13 The ability to integrate knowledge from different fields and manage its complexity.
RA-14 A comprehensive knowledge of applicable methods and techniques and their limitations.
RA-15 Knowledge of all the implications of the practical application of engineering.
RA-16 Demonstrate the generic competences of first-cycle graduates at a higher level characteristic f the master's level.

## CONTENIDOS TEÓRICO-PRÁCTICOS

Unit 1. General aspects - The interaction between system and mechanical manufacturing process
1. Introduction
2. General rules for manufacturing design (DFM)
3. Automotive sector
4. White line sector
5. Aeronautical sector
6. Other sectors: energy, sport, electronics, ...

Unit 2. Sheet metal forming: material characterization
1. Introduction. Case study: manufacturing a car brake pedal
2. Advanced design of sheet forming operations:
- Materials characterization
- Experimental calculation of stamping operations
- Equipment for sheet metal forming

Unit 3. The machine tool: functions, types and architecture
1. Introduction
2. Main functions of machine tools
3. Types and architectures of machine tools

Unit 4. The machine tool: structural elements and guidance systems
1. Introduction
2. Structural elements
3. Guidance systems
4. Feed drive systems
5. Main spindle drive systems
6. Measuring systems

Unit 5. Multitasking machines and hybrid machines
1. Introduction
2. Milling machine evolution
3. Evolution of the lathe
4. Multitasking machines
5. Hybrid or multi-process machines

Unit 6. Flexible manufacturing systems and transfer machines
1. Definition of Flexible Manufacturing System (FMS)
2. Advantages and disadvantages of FMS
3. Definition of families of parts and compound parts
4. Elements present in a Flexible Manufacturing System
5. Other aspects related to FMS
6. Transfer machines and custom manufacturing systems

Unit 7. Coordinate measuring machines
1. Concept and applications
2. Architectures and choice factors
3. The probe
5. Other components
6. Measurement process

Unit 8. Optical and opto-electronic instruments applied to metrology
1. Optical probes
2. Laser radar
3. Tomography

Unit 9. Measurement by interferometry
1. Fundamentals
2. Machine calibration
3. Sources of error
4. The laser tracker
5. The laser tracer

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Computer practices - working groups (report) | 12,5 | 40 % |
| Workshop practices - working groups (questionnaire) | 12,5 | 32 % |
| Analytical problems - working groups (report) | 12,5 | 48 % |
| Theory | 37,5 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | 6 | | | 5 | | | 4 | |
| Horas de Actividad No Presencial del Alumno/a | 22,5 | 6,5 | | | 7,5 | | | 8,5 | |

**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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 25 % | 50 % |
| Presentations | 10 % | 25 % |
| Practical tasks | 35 % | 50 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the theoretical part is carried out by means of a single eliminatory exam. The weight of the final mark of the exam is 35%.

The evaluation of work derived from computer sessions and from the seminar

The performance of these works is considered mandatory for those students who opt for continuous evaluation. As a whole, the work of the computer sessions together with a two process sheets that the students must deliver will have a relative weight of 50% of the total.

Evaluation of the industrial workshop practices

The positive evaluation of the industrial workshop practices goes through the realization of the two proposed practices, in addition to the approval of the teacher based on a satisfactory use of them. In case of doing them, the total of 15% of the final grade will be available. In each practical session the student must complete some scripts provided by the teacher, which will be evaluated by the teacher and delivered to the corrected student.

En la siguiente tabla se resumen las opciones de que disponen los alumnos para llevar a cabo su evaluación.

The following table summarizes the options available to students to carry out their evaluation.

| | Option 1<br>Non-continuous evaluation | Option 2<br>Continuous evaluation |
|---|---|---|
| Exam | 100% | 35% |
| Workshop (*) | - | 15% |
| PamStamp and process sheet works | - | 50% |

(*)You must attend all the Industrial Workshop sessions.

The minimum grade in each block of option 2 must be 4 to be able to average. In the works a minimum grade of 4 is requested in each. In the written exam (option 1 and 2), you will be asked separately to have a minimum grade of 3.5 both in theory and in the numerical problem.

The approval 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.

* 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.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In this case, the student can save the marks related to the practices and group-works.

The evaluation of the theoretical part is carried out by means of a single eliminatory exam. The weight of the final mark of the exam is 35%.

The evaluation of work derived from computer sessions and from the seminar

The performance of these works is considered mandatory for those students who opt for continuous evaluation. As a

whole, the work of the computer sessions together with a two process sheets that the students must deliver will have a relative weight of 50% of the total.

Evaluation of the industrial workshop practices

The positive evaluation of the industrial workshop practices goes through the realization of the two proposed practices, in addition to the approval of the teacher based on a satisfactory use of them. In case of doing them, the total of 15% of the final grade will be available. In each practical session the student must complete some scripts provided by the teacher, which will be evaluated by the teacher and delivered to the corrected student.

En la siguiente tabla se resumen las opciones de que disponen los alumnos para llevar a cabo su evaluación.

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| Exam | 100% | 35% |
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| PamStamp and process sheet works | - | 50% |

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The minimum grade in each block of option 2 must be 4 to be able to average. In the works a minimum grade of 4 is requested in each. In the written exam (option 1 and 2), you will be asked separately to have a minimum grade of 3.5 both in theory and in the numerical problem.

The approval 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.

* 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.

## MANDATORY MATERIALS

Slides projected by the lecturers are available in E-gela platform.

## BIBLIOGRAFÍA

### Basic bibliography

Tool and Manufacturing Engineers Handbook
Society of Manufacturing Engineers
Varios volúmenes

Fundamentals of machining and machine tools
G. Boothroyd, W.A. Knight
CRC Taylor and Francis
2006

### Detailed bibliography

Mecanizado de Alto Rendimiento
L.N. López de Lacalle, J.A. Sánchez, A. Lamikiz
Ediciones Técnicas Izaro
2004

Machine Tools for High Performance Machining
L.N. López de Lacalle, A. Lamikiz
Springer
2009

Mecanizado de Alta Velocidad y Gran Precisión
Arnone, M.
Editorial: El Mercado técnico SL
2000

Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design
Y. Altintas

Editorial: Cambridge University Press Date Published 2000

**Journals**

Información de Máquina-Herramienta Española (IMHE)
Ediciones Técnicas Izaro

European Tool and Mould Making

**Web sites of interest**

www.afm.es
www.cem.es
http://machinedesign.com/channel/motion-control-mechatronics

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** ININD902 - Master in Industrial Engineering
**Year** Second year

## COURSE

503915 - Project Management
**Credits, ECTS:** 6

## COURSE DESCRIPTION

The course focuses on giving an integrated vision of project management, from its genesis to its implementation, contemplating the processes of planning, organization, coordination and control of the project.

In addition to working on the technical skills that a Project Director must have, the subject presents concepts related to personal skills, such as leadership or stakeholder management. Therefore, the subject is understood as an extension of the Grade subject "Engineering Projects".

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

G6. Capacidades para organización del trabajo y gestión de recursos humanos. Conocimientos sobre prevención de riesgos laborales.
G7. Conocimientos y capacidades para la dirección integrada de proyectos.
G8. Capacidad para la gestión de la Investigación, Desarrollo e Innovación tecnológica.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

a) Reinforce general concepts of Project Management.
b) Develop the ability to evaluate the success and performance of a project through metrics.
c) To know the capabilities and leadership styles that a Project Manager must have.
d) To know and put into practice techniques for the control and monitoring of projects.
e) To know aspects of R+D+i management and the different financing structures.
f) To develop skills to define, plan, control, etc. a project integrating all the knowledge acquired throughout the degree and the subject.

## CONTENIDOS TEÓRICO-PRÁCTICOS

GENERAL AGENDA:
1. Project management.
2. The director of the project. The organization of the project. Functional, matrix, mixed organization charts.
3. Management of resources and stakeholders.
4. Economic and financial aspects of the project
5. Project planning.
6. Project control and monitoring
7. Leadership. Teamwork
8. Analysis of the environmental and social impact of the project
9. Legislation
10. How to present a teamwork

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Lectures | 30 | 33 % |
| Computer practicals | 30 | 66 % |
| Seminars | 90 | 33 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 10 | 30 | | | 20 | | | | |
| Horas de Actividad No Presencial del Alumno/a | 20 | 60 | | | 10 | | | | |

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

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 15 % | 25 % |

| | | |
|---|---|---|
| Presentations | 15 % | 25 % |
| Practical tasks | 60 % | 80 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the subject is carried out continuously throughout the course.
The following factors are taken into account in the grading of the course:
Exam (20%): As in the certification exams of the associations of project management professionals, the exam will be in the form of a test with several answer options. In order to pass the course, the exam must have obtained a grade higher than 5 out of 10.
Seminar (50%): At the beginning of the course, students will be assigned to work teams of 4 to 6 people. Each team will have to deliver a work designated at the beginning of the course. The work will be delivered by uploading it to egela within the defined deadlines. The work will also be defended orally. In order to pass the course, the work must have obtained a grade higher than 5 out of 10.
Laboratory practices (30%): The students will have to carry out the indicated practices and deliver the corresponding report. The work will be delivered by uploading it to egela within the defined deadlines. In order to pass the course, the work must have obtained a grade higher than 5 out of 10.
The grade of the course will be obtained by applying to each of the factors (exam, seminar, laboratory practices) its corresponding weight.
If the exam grade is lower than 5.0, the final grade for the course will be that corresponding to the exam grade.
If any of the other two parts (seminar or laboratory practices) has not passed the established cut-off mark, the final grade of the course will be that corresponding to the grade of the part not passed.
If the student decides to waive the Continuous Evaluation of this subject, he/she must communicate it in writing before the deadline for the presentation of the individual work. This date can be found in the Student Guide handed out in class and available in the eGela platform.
In this case, in order to pass the course, the student will be evaluated through a written exam that may contain additional questions to those posed in the exam to which continuously evaluated students are submitted and that will include all the contents studied throughout the four-month period corresponding to the exam. This evaluation will be completed with an oral exam that will take place on the same day of the written exam, prior appointment to the students enrolled in that call.
In the oral exam the students will be asked about the contents studied in the classroom, as well as about the activities carried out during the corresponding four-month period. The student, in order to pass the course, must pass both tests.
In the event that health 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 students will be promptly informed (applicable to all the calls: ordinary, extraordinary and advance).

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Those who must submit to the extraordinary call will do so in the same way in which they presented themselves in the ordinary call. That is to say, those who underwent the continuous evaluation, will complete the tests (exam, seminar, laboratory practices) that they did not pass in the ordinary call.
The grade for the course will be obtained by applying the corresponding weight to each of the factors (exam, seminar, laboratory practices).
If the exam grade is lower than 5.0, the final grade of the course will be the one corresponding to the exam grade.
If any of the other two parts (seminar or laboratory practices) has not passed the established cut-off mark, the final grade for the course will be that corresponding to the grade of the part not passed.
Those who waived the continuous evaluation, will be submitted to a written and oral exam as described in the previous section (Ordinary call: orientations and waiver).

## MANDATORY MATERIALS

1.- PMI, Project Management Body of Knowledge 6th edition, Project Management Institute, 2017
2.- IPMA, National Competence Baselines ICB4, 2015

## BIBLIOGRAFÍA

### Basic bibliography

Kerzner H., PhD. "Project Management. A systems approach to planning, scheduling and control" 10th edition, Wiley & Sons, 2009
PMI Standards Committee, "A guide to the Project Management Body of Knowledge (PMBOK guide)", 6th edition, 2017
IPMA, IPMA Competence Baselines ICB4, 2015
Fleming Q., Koppelman J., "Earned Value Project Management (Fourth Edition)", Project Management Institute, 2010
Burke R., "Project Management. Planning and Control techniques", Wiley & Sons, 2003
Anbari, F. "Earned value method and extensions" Project Management Journal, vol.34(4), pp. 12‐23, 2003
Burke R., Barron S., "Project Management Leadership: Building Creative Teams", Wiley, 2014
Grisham T., "International Project Management: Leadership in Complex Environments", Wiley, 2010
Klippenborg T., Shriberg A., Venkatram J. "Project Leadership (The Project Management Essential Library)", Management Concepts, 2003

Kerzner H., "R&D project management", Wiley, 2015

**Detailed bibliography**

Turner J.R., "The handbook of Project-based Management", McGraw-Hill, 2012
Vanhoucke M., "Integrated Project Management Sourcebook", A Technical Guide to Project Scheduling, Risk and Control, Springer, 2016
Kerzner H., "Project Management Metrics, KPIs, and Dashboards. A Guide to Measuring and Monitoring Project Performance", Wiley, 2013
Practice Standard for Earned Value Management, PMI, 2005
National Defense Industrial Association (NDIA) Program Management Systems Committee (PMSC), ANSI/EIA-748-A Standard for Earned Value Management Systems Intent Guide, 2005
Lipke W., Schedule is different, The Measurable News Summer, 31-34, 2003

**Journals**

International Journal of Project Management
Project Management Journal
R&D Management

**Web sites of interest**

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

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** ININD902 - Master in Industrial Engineering
**Year** First year

## COURSE

503922 - Parametric Modelling and Design
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

Computer Aided Design Techniques for industrial design. Computational geometry. Curves, surfaces and solids. Parametric modelling. Virtual simulation. Engineering standards. Industrial applications of CAD systems.

In case health conditions prevent a teaching activity or face-to-face evaluation, non-presential options will be enabled and students will be informed immediately.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocimiento y capacidad para proyectar, calcular y diseñar sistemas integrados de fabricación.
Capacidad para el diseño y ensayo de máquinas.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Unit 1. Introduction to industrial graphics. Graphic treatment of information.
Unit 2. CAD Methodology and techniques applied to industrial design.
Unit 3. Fundamentals of Computational Geometry. Treatment of curves, surfaces and volumes with the computer.
Unit 4. Parametric and variational modelling.
Unit 5. Virtual simulations.
Unit 6. Obtaining perspectives and realistic images.
Unit 7. Standardized representation in engineering. Standardization and dimensioning with the computer.
Unit 8. Fulfillment of an industrial design project.
Unit 9.- Industrial applications of CAD systems. Associations with close technological environments (CAM, CAE, GIS, etc.).

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Lectures | 37,5 | 40 % |
| Laboratory practicals | 75 | 40 % |

## 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 15 % | 40 % |
| Otros | 15 % | 40 % |
| Practical tasks | 40 % | 70 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

1.- Fundamentos de Dibujo. <W.J. Luzadder>.
2.- El dibujo industrial. <A. Chevalier>.
3.- Dibujo Técnico. <A. Bachman>.
4.- Dibujo Industrial. <J..Félez y M.L. Martínez>.
5.- CAD-CAM. <Barry Hawkes>.
6.- CAD/CAM Theory and Practice. <Ibrahim Zeid>.
7.- Fundamental of interactive Computer Graphics. <J.D. Foley y A..Van Dam>.
8.- Computational Geometry for Design and Manufacture. <I.D. Faux y M.J. Pratt>.
9.- Geometric Modeling. <M.E. Mortenson>.
10.- Parametric and Feature Based CAD/CAM. <J. Shah y M. Mäntylä>.
11.- Manual de Normas: UNE/ISO/DIN/AFNOR/ANSI. <AENOR>.
12.- Engineering Technical Drafting. <J.W. Giachino y H.J. Beukema>.

### Detailed bibliography

1.- CAD Tools and Algorithms for Product Design. <P. Brunet; C. Hoffmann y D. Roller>.
2.- Geometric Modelling. <G. Brunnett, H. Bieri y G. Farin>.
3.- Curves and surfaces for computer aided geometric design: a practical guide. <G..Farin>.
4.- Principles of CAD/CAM/CAE Systems. <Kunwoo Lee>.
5.- Applied Geometry for Computer Graphics and CAD. <Duncan Marsh>.
6.- CAD after 2000: integrated, intelligent, collaborative. <L.Piegl y J. Woodwark>.

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** ININD902 - Master in Industrial Engineering
**Year** First year

## COURSE

503923 - Product Life Cycle
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

Introduction to the product life cycle. Information management systems. Design of the product structure. Software for product data management. Implementation of a PLM (Product Life Cycle Management) system.

In case health conditions prevent a teaching activity or face-to-face evaluation, non-presential options will be enabled and students will be informed immediately.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocimiento y capacidades para el proyectar y diseñar instalaciones de Seguridad.
Conocimientos y capacidades para realizar verificación y control de instalaciones, procesos y productos.
Conocimientos y capacidades para realizar certificaciones, auditorías, verificaciones, ensayos e informes.
Conocimiento y capacidad para proyectar, calcular y diseñar sistemas integrados de fabricación.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Unit 1. Introduction to product life cycle.
Unit 2. Principles of product life cycle.
Unit 3. Information management systems.
Unit 4. Product structure.
Unit 5. Integration of a PLM system in other applications.
Unit 6. Implementation of a PLM system.
Unit 7. PLM strategies.
Unit 8. Integrative exercise of competencies.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Lectures | 37,5 | 40 % |
| Laboratory practicals | 75 | 40 % |

## 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
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GO: Applied computer-based groups
GCL: Applied clinical-based groups
TA: Workshop
TI: Industrial workshop
GCA: Applied fieldwork groups

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 15 % | 40 % |
| Otros | 15 % | 40 % |
| Practical tasks | 40 % | 70 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

Product Lifecycle Management. <Antti Saaksvuori - Anselmi Immonen>.
Global Product. <John Stark>.
Product Lifecycle Management. <Michael Grieves>.
Product Design. Practical Methods for the Systematic Development of New Products. <M. Baxter>.
Product Lifecycle Management: 21st century paradigma for product realisation. <Stark>.
PDM: Product Data Management. <R. Burden>.
The Product Managers Handbook: The complete Product Management Resource. <Linda Gorchels>.
Life Cycle Management. <David Hunkeler>.

### Detailed bibliography

The basics of process mapping.  <Robert Donelio>.
Bills of Material for a Lean Enterprise . <Dave Garwood>.
Manufacturing Data Structures: building foundations for excellence with BOM and process information <J.Clement>.
Implementing and Integrating Product Data Management and Software Configuration Management. <I.Crnkovic>.
Collaborative Design and Manufacturing Methodologies and Applications. <W.D. Li - S.K.Ong>.
Class A ERP Implementation: Integrating Lean and Six Sigma. . <Donald H. Sheldon>.

### Journals

### Web sites of interest

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable

**Degree** ININD901 - Master in Industrial Engineering
**Year** Not Applicable

## COURSE

503955 - Integration of Industrial Systems
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

The aim is to provide the student with the fundamentals, techniques and technologies used in the integration of control systems in an automated industrial environment, with emphasis on information exchange and supervision systems.

The course looks for a balance between theoretical, methodological, technological and practical subjects.
- Theoretical regarding basics on industrial systems integration and the necessary elements. It will start from the knowledge acquired in the course "Process Automation" taught in the fourth year of the Degree in Industrial Technology In the pre-intensification in Electrical, Electronics and Control Technologies.
- Methodological regarding on the design of systems for automated production systems.
- Technological regarding on the study of devices and components in industrial communications and monitoring systems.
- Practical regarding on to laboratory sessions that will be held on programmable logic controllers (PLCs) and industrial communications networks, in order to solve real automation issues.

In the event that the 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.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

THEORETICAL SUBJECTS:

1st Lesson. Basic concepts in industrial communications. Automation layers. Communication networks. Transmission media and types. Monitoring systems. Encoding and data transmission. Serial protocols in manufacturing environments.
2nd Lesson. Network architecture. OSI from ISO Reference model. Hierarchy of protocols. Reference levels. Industrial network architectures.
3rd Lesson. Industrial communications. Device-oriented: network buses and architectures. Control-oriented: control buses. Plant networks.
4th Lesson. Industrial networks. Features. Network topologies and transmission media. Network architectures.
5th Lesson. Distributed control systems. Monitoring and Monitoring Systems.

TEORICAL SUBJECTS DEVELOPMENT (10 sessions 1,5 hours):

1st BLOCK - Basics in Industrial Communications

1st Lesson. Introduction to Industrial Communications
Basic concepts: Data acquisition and control, transformation of analog signals, data transmission, encoding, communication protocols, basic link protocols.

2nd BLOCK - Network architecture

2nd Lesson. OSI/ISO architecture
Hierarchies of protocols, reference levels, communication between levels, data units, services and primitives, industrial network architectures, plant networks, field buses.

3rd BLOCK - Industrial Communications

3rd Lesson. Actuator/Sensor buses
3.1 Lesson. AS-i Bus: Overview of the AS-i bus, basic bus components, general characteristics, physical level, data link level, active and passive components, frames and services, profiles, functions, network diagnostics, AS-i v2.1 specification.
3.2 Lesson. Programming Basics - STEP7: Program structure, Module types, Processing types, Cycle and response times.

4th Lesson. Field buses
4.1 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.
4.2 Lesson. CAN: General features, data link, broadcast communication, remote frame request, bus arbitration, communication services, CAN frames, error handling.

5th Lesson. Industrial Ethernet
5.1 Lesson. Ethernet Basics: Technical features, Ethernet types, Frame types, Media access method, Ethernet problems in the industry, Network topologies, Bus components, Transmission media, Industrial Ethernet solutions.
5.2 Lesson. Ethernet TCP/IP: General features, IP stack, TCP or ISO, TCP/IP (features, Internet level, Transport level, Application level), programming interfaces.
5.3 Lesson. PROFInet: Transmission types, real-time communication, decentralized field devices, motion control, decentralized automation, network installation, IT standards, network access security, safety, process.

4th BLOCK - Distributed control systems. Monitoring and Monitoring Systems.

6th Lesson. OPC
6.1 Lesson. Classic OPC: Purpose, situation, architecture, OPC databases, objects and interfaces, OPC applications, general architecture and components, local and remote servers, OPC standards.
6.2 Lesson. OPC UA: Main Features, fundamental components, architecture levels, specifications set, transport protocols, data model, information model, services, profiles, security, information modelling (space address, nodes and references, events , historical access), applications development.

7th Lesson. Supervisory Systems
Goals. Types and benefits. Process monitoring technologies. Acquisition. Registry. Process representation. Detection of failures. Tools of knowledge management and decision making. Interfaces, SCADAs.

SEMINAR SUBJECTS:DEVELOPMENT (10 sessions 1,5 hour):

- 1st Seminar: Industrial communications basics - Serial communications
- 2nd Seminar: SIMATIC communications
- 3rd Seminar: AS-i
- 4th Seminar: PROFIBUS-DP
- 5th Seminar: DeviceNet
- 6th Seminar: TCP/IP
- 7td Seminar: PROFInet-IO
- 8td Seminar: OPC-DA
- 9td Seminar: OPC-UA
- 10td Seminar: SCADA systems

PRACTICAL SUBJECTS:DEVELOPMENT (8 sessions):

- 1st Practice: S7 communications (1,5 horas)
- 2nd Practice: Process control communications - AS-i (1,5 horas)
- 3rd Practice: I/O communications - PROFIBUS-DP 1/2 (2 hours)
- 4th Practice: I/O communications - PROFIBUS-DP 2/2 (2 hours)
- 5th Practice: IE communications - TCP/IP (2 hours)
- 6th Practice: I/O communications - PROFInet-IO 1/2 (2 hours)
- 7th Practice: OPC-DA communications (2 hours)
- 8th Practice: Supervisory systems (2 hours)

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Lectures | 37,5 | 40 % |
| Seminars | 37,5 | 40 % |
| Laboratory practicals | 37,5 | 40 % |

## 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
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GL: Applied laboratory-based groups
GO: Applied computer-based groups
GCL: Applied clinical-based groups
TA: Workshop
TI: Industrial workshop
GCA: Applied fieldwork groups

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 40 % | 70 % |
| Otros | 0 % | 10 % |
| Practical tasks | 30 % | 60 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Written Test: 70% (Pass score 40%)
Seminar/Laboratory: 30% (Continuous Assessment)
Disposition for Seminar Sessions: 5% (Independent work - Pass score 70%)
Laboratory Reports: 10% (Independent work - Pass score 50%)
Laboratory Practices: 15% (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: 70% (Pass score 50%)
Laboratory Test: 30% (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

Documentation corresponding to the transparencies supporting the theory, seminars and laboratory is in the virtual classroom of the subject.

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

Hardware equipment:
- Personal computers
- Programmable controllers - SIMATIC-S7-1500
- Communications processors - As-i, PB-DP, PN-IO
- Frequency inverters SINAMIC G120
- Manufacturing cells - FESTO MecLab
- Heterogeneous platforms - Arduino UNO / Ethernet Shield

## BIBLIOGRAFÍA

### Basic bibliography

Title: Comunicaciones Industriales: Principios básicos
Authors: M. A. Castro Gil, G. Díaz Orueta, F. Mur Pérez, R. Sebastián Fernández, etc.
Publisher: UNED
Year of Publication: 2007

Title: Comunicaciones Industriales: Sistemas Distribuidos y Aplicaciones
Authors: M. A. Castro Gil, G. Díaz Orueta, F. Mur Pérez, R. Sebastián Fernández, etc.
Publisher: UNED
Year of Publication: 2010

Title: Redes de Computadoras
Authors: A. S. Tanenbaum
Publisher: Pearson Universidad. 5ª edición
Year of Publication: 2013

Title: Comunicaciones Industriales. Guía Práctica
Authors: Aquilino Rodríguez Penín
Publisher: Marcombo, Ediciones Técnicas
Year of Publication: 2002

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

Title: Automating with PROFINET (2nd edition)
Authors: R. Pigan, M. Metter
Publisher: Wiley
Year of Publication: 2008

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

Title: Sistemas de Supervisión (2ª Edición)
Authors: J. Colomer, J. Meléndez, J. Ayza.
Publisher: Cuadernos CEA-IFAC. Cetisa / Boixareu Editores
Year of Publication: 2001

### Detailed bibliography

Title: Comunicaciones Industriales. Guía Práctica
Authors: Aquilino Rodríguez Penín
Publisher: Marcombo, Ediciones Técnicas
Year of Publication: 2008

Title: Communication Networks for Manufacturing
Authors: J.R. Pimentel
Publisher: Prentice - Hall International
Year of Publication: 1990

Title: Comunicaciones Industriales
Authors: V. Guerrero, L. Martínez y R.L. Yuste
Publisher: Marcombo
Year of Publication: 2010

Title: AS-Interface. The Actuator-Sensor-Interface for Automation
Authors: W.R. Kriesel, O.W. Madelung
Publisher: Editorial Hanser. 2ª edición
Year of Publication: 1999

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

Title: Profibus PA. Instrumentation Technology for the Process Industry
Authors: Ch. Diedrich, Th. Bangemann.
Publisher: Oldenbourg Industrieverlag GmbH
Year of Publication: 2002

Title: Controller Area Network. Basic, Protocols, Chips and Applications
Authors: K. Etschberger
Publisher: IXXAT Press
Year of Publication: 2001

Title: OPC Unified Architecture
Authors: W. Mahnke, S.-H. Leitner, M. Damm
Publisher: Springer
Year of Publication: 2009

Title: Sistemas SCADA (2ª Edición)
Authors: A. Rodríguez
Publisher: Marcombo, Ediciones Técnicas
Year of Publication: 2007

Title: Aprenda WinCC
Authors: J. Martínez Torres, J.M. Díez Aznar
Publisher: Editorial de la Universidad Politécnica de Valencia
Year of Publication: 2011

**Journals**

Automática e Instrumentación http://www.tecnipublicaciones.com/automatica/
IEEE Transactions on Industrial Informatics. http://www.ieee.org/
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/
Open DeviceNet Vendor Association http://www.odva.org
EtherCAT Technology Group http://www.ethercat.org
OPC Foundation http://www.opcfoundation.org

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** ININD902 - Master in Industrial Engineering
**Year** First year

## COURSE

503959 - Management of Hydraulic Resources and Hydro-Electric Plants
**Credits, ECTS:** 6

## COURSE DESCRIPTION

With this subject the student will be provided with an elementary theoretical base to solve specific problems, typical within engineering, in the management of hydraulic resources and hydroelectric facilities.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocimientos y capacidades para realizar verificación y control de instalaciones, procesos y productos.
Conocimientos y capacidades para el diseño y análisis de máquinas y motores térmicos, máquinas hidráulicas e instalaciones de calor y frío industrial
Conocimiento y capacidades para el proyectar y diseñar instalaciones eléctricas y de fluidos, iluminación, climatización y ventilación, ahorro y eficiencia energética, acústica, comunicaciones, domótica y edificios inteligentes e instalaciones de Seguridad.
Proyectar, calcular, diseñar y gestionar recursos hidráulicos y centrales hidroeléctricas.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Topic 1. Water and hydrology. Antecedents of hydraulic planning. Scope. Water management in the world. Applications. The balance between uses and resources. Necessary endowments of use. The management of demand. Water cycle. Precipitation. Surface water. Watersheds. Stochastic analysis of hydrological information.

Topic 2. Physical principles of hydroelectric exploitation. Review of the principles of fluid mechanics.

Topic 3. Hydraulic systems for the use of resources. Regulation and energy accumulation. Description of the works to be done in order to take advantage of the different resources.

Topic 4. Hydroelectric power plants. Types of facilities. Control of facilities and audits. Types of hydroelectric power plants. Facilities. Maintenance and control. The process of auditing this type of facility.

Topic 5. Hydroeconomy and master plan for the design of an exploitation. Integral water resources the cost, price and value of water. The cost of a hydroelectric power station. Complete master plan.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Computer practicals | 12,5 | 40 % |
| Field practicals | 25 | 40 % |
| Classroom practicals | 37,5 | 40 % |
| Lectures | 75 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 30 | | 15 | | 5 | | | | 10 |
| Horas de Actividad No Presencial del Alumno/a | 45 | | 22,5 | | 7,5 | | | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Otros | 50 % | 50 % |
| Practical tasks | 50 % | 50 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Continuous evaluation will be done, valuing the attendance to class (25%), the participation (25%) and the delivery of the works on the subjects of the subject (50%).

In the ordinary convocatory, the student can be evaluated through the final evaluation system (exam for 100% of the subject), if requested to the teacher responsible for the Group in which he / she has enrolled (in writing, by email, within the established term of the first 9 weeks of the course). In this case, the structure of the final exam for 100% of the subject will maintain identical percentages and criteria for calculating the final grade (through specific exercises of each task).

Failure to perform the face-to-face task and not request a final evaluation means a waiver of the call.

Note.- in case sanitary conditions do not allow carrying out one face-to-face teaching task and/or evaluation, a non faceto-
face modality will be activated and students will be informed punctually (applicable to all calls: ordinary, extraordinary and advance of call).

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary convocatory, the student will be assessed by exam for 100% of the subject maintaining identical percentages and criteria for calculating the final grade.

Failure to submit to the final examination of the extraordinary call supposes the resignation to this convocatory.

## MANDATORY MATERIALS

Gestión de recursos hídricos. Luis Balairón Pérez. Edicions UPC. (Universidad Politécnica de Catalunya. 2000). ISBN: 84-8301-403-3
Energía Minihidráulica. Publicación del Ente Vasco de la Energía. (Bilbao).
Tratado básico de presas y obras hidráulicas. Eugenio Vallarino

## BIBLIOGRAFÍA

### Basic bibliography

Centrales Hidroeléctricas. Ediciones Paraninfo
Saltos de agua y presas de embalse. Gómez Navarro.
Centrales eléctricas I. Ángel Luis Orille Fernandez. Edicions UPC. (Universidad Politécnica de Catalunya. 1997). ISBN: 84-89636-50-8

### Detailed bibliography

Gestion des eaux. F. Valirón. Colegio de Ingenieros de Caminos, Canales y Puertos de Francia. Edición ISBN: 2-85978-157-9.
Hidrología aplicada. Ven Te Chow. Editorial Mc-Graw- Hill. 1993. ISBN: 958-600-171-7

### Journals

Tecnología del agua
Ingeniería del agua

### Web sites of interest

https://www.consorciodeaguas.com/Web/Inicio/index.aspx
ftp://ftp.ehu.es/cidirb/profs/inpibbeg/material_08_09/08_09_3_adicional_bestelakoa/Fernando_Santos_MH_07-08.pdf
http://ga.water.usgs.gov/edu/hyhowworks.html
http://www.youtube.com/watch?v=htT_8sFJx1w

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** ININD902 - Master in Industrial Engineering
**Year** First year

## COURSE

503960 - Oil Hydraulics
**Credits, ECTS:** 3

## COURSE DESCRIPTION

a) The objective of "Fluid power" is to study the generation, transmission and control of motions and forces by pressurized oil. This liquid is an incompressible fluid capable of transmitting high forces at a very high pressure level. This subject completes the core knowledge about hydraulic pumps by introducing the positive displacement machines. This way, the students can perceive a complete perspective of the group of hydraulic machinery.
The subject is developed with a high experimental and practical orientation, so that the student will be able to design a wide variety of fluid power circuits, with the corresponding computational simulation and experimental testing in the hydraulic benches of the laboratory.
The abilities acquired in the subject of fluid power will permit to apply this technique in different industrial fields such as heavy machinery, aircrafts, watercrafts or programmed manufacturing processes. All the necessary components for the fluid power systems will be selected according to the criteria studied in the subject.

b) "Fluid Power" contributes significantly to the development of the competencies under the Industrial Technology Module, in all the subjects related with the positive displacement machinery and its application in any industrial generic projects, integrated manufacturing processes, process control systems or automatic manufacturing systems.

c) The horizontal and vertical coordination of the subject with others is assured by the internal relationship of all the subjects in the Hydraulic Engineering majoring studies and the collaborative work developed by the lecturers in relation to the common competencies developed by the students in the master´s degree and the module (of Industrial Technologies in this case).

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

TI5. Knowledge and capacities for the design and analysis of thermal machinery and motors, hydraulic machinery and industrial heat and cooling facilities.
TI8. Capacity to design and project automated manufacturing systems and advanced control of processes.
IH3. To project, calculate and design fluid networks and fluid power (pneumatic and oil hydraulic) components.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

- Understanding the operation of the machinery and facilities of oil hydraulics by means of the design of its components, basic physical fundamental laws and characteristic curves.
- Planning and designing oil hydraulic facilities.
- Understanding the regulation and control of the processes related to the field of the oil hydraulic machinery and facilities for their optimum management.
- Performing the operation, management, experimental testing and analysis of oil hydraulic facilities.
- Developing technical and diagnostic reports.

## CONTENIDOS TEÓRICO-PRÁCTICOS

CHAPTER 1: INTRODUCTION TO FLUID POWER
1.1. Definition of Fluid Power
1.2. Properties of oil
1.2.1. Viscosity
1.2.2. Desity
1.2.3. Fluency point
1.2.4. Compressibility
1.2.5. Vapour pressure, saturation pressure, cavitation
1.2.6. Emulsion removing capacity
1.2.7. Foam generation
1.2.8. Flammability
1.3. Fundamental laws
1.3.1. Conservation of mass
1.3.2. Conservation of energy
1.3.3. Positive displacement principle
1.3.4. Hydrostatic law and Pascal principle
1.4. Energy transformation
1.5. Advantages and disadvantages of pressurized oil

1.6. Comparison between fluid power pneumatic systems and fluid power hydraulic systems.
CHAPTER 2: THE HYDRAULIC GROUP
2.1. Introduction
2.2. Hydraulic tanks
2.3. Hydraulic pumps
2.3.1. General concepts
2.3.2. Alternative pumps: radial pistons, axial pistons (aligned pistons, inclined swash-plate type, oscillating wobble-plate type, bent axis type), oscillating pistons.
2.3.3. Rotary pumps: external gear, lobe type, screw pump, internal gear (gerotor type and crescent seal type), vane pump
2.4. Filters
CHAPTER 3: ACTUATORS
3.1. Introduction
3.2. Cylinders
3.3. Limited rotation actuators
3.4. Rotary motors
3.5. Hydraulic grippers
CHAPTER 4. VALVES AND HYDRAULIC ACCESORIES
4.1. Introduction
4.2. Pressure valves
4.2.1. Safety relief valves
4.2.2. Sequence valves
4.2.3. Reducing valves
4.2.4. Counterbalance valves
4.2.5. Unloading valve
4.3. Valves for fluid distribution
4.3.1. Directional control valves
4.3.2. Check valves
4.4. Valves for flow regulation
4.4.1. Flow restrictor (uncompensated)
4.4.2. Pressure compensated flow control valve
4.4.3. Flow divider valve
4.5. Proportional valves
4.5.1. Directional (flow control)
4.5.2. Relief valves
4.5.3. Reducing valves
4.6. Servo valves
4.6.1. Feedback signal by pressure
4.6.2. Feedback mechanical signal
4.6.3. Feedback electrical signal
4.7. Cartridge valves
4.8. Other valves
4.9. Accumulators
4.10. Hydraulic-Pneumatic systems
4.10.1. Hydraulic-neumatic converter
4.10.2. Oil breking cylinder
4.10.3. Pressure multiplier
4.11. Other accessories
4.11.1. Manometers
4.11.2. Flowmeters
4.11.3. Pressure switch
4.11.4. Heat exchanger
4.11.5. Joining elements
CHAPTER 5: FLUID POWER HYDRAULIC CIRCUITS
5.1. Differential circuit
5.2. Circuit with actuator in series
5.3. Circuit with actuator in parallel
5.4. Circuit with heavy traction loads
5.5. Sequence control in two cylinders
5.6. Hydraulic press
5.7. Drill with different forward velocities
5.8. Circuits for a rotary hydraulic motor
5.9. Hydraulic maintenance
CHAPTER 6: CALCULATIONS IN A HYDRAULIC CIRCUIT
6.1. Cylinder selection

6.2. Directional valve
6.3. Pipes
6.4. Pump selection
6.5. Safety valve
6.6. Accumulator
6.7. Tank
6.8. Refrigerator

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LAB EXPERIMENTS
Practical 1: Gear pump, blocking valve, manometer
Practical 2: Pressure relief valve
Practical 3: Directional valve
Practical 4: Simple effect cylinder
Practical 5: Double effect cylinder
Practical 6: Check valve
Practical 7: Flow restrictor valve
Practical 8: Compensated flow control valve
Practical 9: Fluid flow resistance
Practical 10: Differential circuit
Practical 11: Pressure counterbalance
Practical 12: Flow control as a functin of the stroke
Practical 13: Flow restrictor with chechk valve in parallel
Practical 14: Pilot operated check valve
Practical 15: Inflow control
Practical 16: Outflow control
Practical 17: Pressure operated sequence of actuators
Practical 18: Pressure reducing valve
Practical 19: Pilot operated pressure relief valve
Practical 20: Hydraulic motor
Practical 21: Accumulator
Practical 22: Circuit with fast/slow motion

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Laboratory practicals | 37,5 | 50 % |
| Lectures | 37,5 | 50 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 15 | | | 15 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Otros | 40 % | 60 % |
| Practical tasks | 40 % | 60 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

GRADING POLICY AND TASKS: the grading system corresponds to "continuous assessment".

T1: 40% practical tasks
T2: 60% Laboratory experiments
The attendance to classes (either theoretical or practical) is part of the evaluation of each task within the continuous evaluation.

In the ordinary call the student can be evaluated by the final exam system (by an exercise on 100% of the subject), providing they claim for it to the teacher responsible of the group where they are enrolled in. The request must be forwarded by electronic mail during the 9 first weeks of the year. In this case the structure of the exam will maintain the

same percentages and calculation method to obtain the final mark from the 2 tasks of the subject T1 and T2 (assessed through specific exercises).

The absence of in-person task T2 and not having requested the final exam will be considered a withdrawal from the ordinary call.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary call, the student has to sit an exam with a grading weight of 100% with the same percentages and calculation criterion of the final mark as in the ordinary call.

Not sitting the final exam T1 in the extraordinary call will be considered a withdrawal from that call.

## MANDATORY MATERIALS

- G. A. Esteban Alcalá, Collection of slides, "Fluid power", 2018, Bilbao.
- HRE-HIDRAULIC, COMPENDIUM OF LAB PRACTICALS. 2018.

## BIBLIOGRAFÍA

### Basic bibliography

1. A. Serrano Nicolás, Oleohidráulica, 1ª ed., McGraw-Hill, Madrid, 2002.
2. Felip Roca Ravell, Oleohidráulica básica, Edicions UPC, Barcelona, 1998.
3. J. Almandoz Berrondo et al., Sistemas Neumáticos y Oleohidráulicos, Escuela Universitaria Politécnica, Donostia, 2007.
4. Roldán Viloria, José. NEUMÁTICA, HIDRÁULICA Y ELECTRICIDAD APLICADA. Editorial Thomson-Paraninfo. 2001
Colección de películas:
1. Introduction to Fluid Power, Meridian Education Corporation (19 min)
2. Fluid Power Technology: At Work, Meridian Education Corporation (23 min)
3. Fluid Power Technology: Pumps, Lines, Filters, Meridian Education Corporation (28 min)
4. Fluid Power Technology: Actuators, Meridian Education Corporation (22 min)
5. Fluid Power Technology: Control Mechanisms, Meridian Education Corporation (25 min)

### Detailed bibliography

1. Andrew Parr, Hydraulics and Pneumatics, 2nd ed., Butterworth-Heinemann, Oxford, 1998.
2. Qin Zhang, Basics of Hydraulic Systems, CRC Press, London, 2009.
3. Mannesmann -Rexroth, Proyecto y Construcción de equipos hidráulicos, Goimendi S.A., 1988.
4. Mannesmann - Rexroth, Fundamentos y componentes de la oleohidráulica : Manual de enseñanza e información sobre fundamentos y componentes de la técnica de fluidos,oleohidráulica, 1991.
5. Frank Yeaple, Fluid Power Design Handbook, 3rd ed., Marcel Dekker Inc., New York, 1996.
6. Antonio Díez de la Cortina León, Manual de Oleohidráulica, Creaciones Copyright S.L., España, 2008.
7. E. Carnicer Royo, C. Mainar Hasta, Oleohidráulica, Conceptos básicos, 2ª ed., Thomson Paraninfo, Madrid, 1998.
8. E. C. Fitch, I. T. Hong, Hydraulic Component Design and Selection, BarDyne, 1998.

### Journals

Hydraulics and pneumatics. Industrial Publishing. Cleveland. Estados Unidos de América. ISSN: 0018-814X
FLUIDOS: Oleohidráulica, Neumática y Automoción. PUBLICA S. A., Barcelona, España. ISSN 0211-1136

### Web sites of interest

Videos de clases (nivél básico, generalista):

1) Will Durfee and James D. Van de Ven
Dpt. Mechanical Engineering, University of Minnesota
https://www.youtube.com/playlist?list=PL_onPhFCkVQhN-72royiGW36C-kFBpYlS

2) Jim Pytel
Bigbadtech channel (funded by National Science Foundation)
https://www.youtube.com/playlist?list=PLdnqjKaksr8ruhw85YYSSO6EWLhVVmSKm

Casas comerciales:

GLUAL:
http://www.glual.es/es/home.html

HINE:
http://www.hine.es/

ROQUET:
http://www.pedro-roquet.com/es_ES/

ENERPAC:
http://www.enerpac.com/es

Bosch Rexroth:
http://www.boschrexroth.com/en/xc/
http://www.boschrexroth.com/es/es/

PARKER:
http://www.parker.com/

EATON: (VICKERS, AEROQUIP IBÉRICA,…)
http://www.eaton.com/

Danfoss:
http://powersolutions.danfoss.com/home/

WALVOIL:
http://www.walvoil.com/

HIDRAM
http://www.hidram.com/

MOOG:
http://www.servovalve.com/

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504005 - Electronic Communications Systems
**Credits, ECTS:** 9

## COURSE DESCRIPTION

The subject belongs to the first year of the Master's degree in telecommunication engineering.
It studies and expands knowledge about design of electronic instrumentation and electronic communications systems with emphasis on RF systems. Electronic circuits and systems for signal conditioning, acquisition, processing and transmission of signals generated by sensors, transducers and telecommunication systems are studied. It requires knowledge and skills with design, verification and circuit manufacturing tools.
In the event that the 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.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para utilizar dispositivos lógicos programables, así como para diseñar sistemas electrónicos avanzados, tanto analógicos como digitales. Capacidad para diseñar componentes de comunicaciones como por ejemplo encaminadores, conmutadores, concentradores, emisores y receptores en diferentes bandas.
Capacidad para desarrollar instrumentación electrónica, así como transductores, actuadores y sensores.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Theory
- Components and devices in electronic instrumentation.
- Electronic instrumentation systems for signal acquisition, control and processing.
- Components and devices in telecommunications systems.
- Electronic systems and signal conditioning in telecommunications.
- Treatment and acquisition of signals. Modulation-demodulation and A/D-D/A converters.
- Interference signals, treatment and electromagnetic compatibility.

- Design and specifications of RF systems. Link Budget.
- Discrete passive and active RF components. Transmission lines and adaptation networks.
- Active and Passive Filters
- RF Small Signal Amplifiers.
- Oscillators and frequency synthesizers.
- Mixers and phase circuits.
- RF power amplifiers.

Lab practices:
The laboratory sessions develop the concepts adquire in theory through practical circuits that the student must design and assemble.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Classroom practicals | 15 | 40 % |
| Laboratory practicals | 75 | 40 % |
| Lectures | 135 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 54 | | 6 | 30 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 81 | | 9 | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 60 % | 60 % |
| Practical tasks | 40 % | 40 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

To pass the subject is mandatory to pass each and every one of the parts individually.
- Theoretical part: It is necessary to individually pass all the examinations of the ordinary call.
- Practical part: Attendance to laboratory sessions is mandatory to pass the practical part.
It is necessary to individually pass each of the parts of the laboratory.
The resignation procedure will be the one included in the corresponding regulations. The student who resigns continuous evaluation will be assessed for the 100% of the subject by means of a test that includes both the theoretical and the practice part.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Same criteria as in the ordinary call.
Scores in either of the two parts (theory and practices) will only be kept until the extraordinary examination sitting of the same academic year

## MANDATORY MATERIALS

KICAD,Orcad, PSpice, LTspice, Keysight ADS or equivalent CAD/CAE software.

## BIBLIOGRAFÍA

### Basic bibliography

Practical Design Techniques for Sensor Signal Conditioning. Analogue Devices, 1999.
Electronic Instrumentation. H .S. Kalsi. 2010.
Instrumentación Electrónica. M. A. Perez, J, C. Alvarez, Thompson Paraninfo 2003.
RF Circuit Design, Christopher Bowick, 2nd Edition, Newnes-Elsevier 2008.
Microwave Engineering, David M Pozar, 4Ed, Wiley, 2012.
Solid State Radio Engineering, Herbert L. Krauss and Charles W. Bostian, John Wiley & Sons. 1980

### Detailed bibliography

Measurement, Instrumentation and Sensors Handbook. 2nd Edition. CRC Press, 2014.
Principles of Electronic Communication Systems. Louis E. Frenzel (Jan 26, 2007).
Electronic Instrumentation. U.A.Bakshi, A.V.Bakshi. 2009.
Design and development of medical electronic instrumentation. David Prutchi, Michael Norris. 2005.
Electronics Measurements And Instrumentation. U.A.Bakshi, A.V.Bakshi - 2009
Modern Electronic Communication (9th Edition) by Jeff Beasley and Gary M. Miller (May 6, 2007)
Electromagnetics Explained: A Handbook for Wireless/ RF, EMC, and High-Speed Electronics (EDN Series for Design Engineers) by Ron Schmitt (May 27, 2002)
RF Circuit Design. Theory and Applications. Reinhold Ludwing, G. Bogdanov. 2nd Edition, Perarson Prentice Hall, 2009.
Analog-Digital Conversión. Analog Devices.

### Journals

http://www.electronics-eetimes.com/en/magazine/magazine-eetimes.html
Microwaves & RF [news@news.mwrf.com]
Microwaves Journal
Microwave Engineering Europe [microwave@electronics-eetimes.com]
analog@electronics-eetimes.com

### Web sites of interest

http://www.cadence.com/products/orcad/pages/default.aspx
http://web.awrcorp.com/Usa/Products/Microwave-Office/
http://www.ni.com/labview/
http://www.electronics-eetimes.com/en/magazine/magazine-eetimes.html
Microwaves & RF [news@news.mwrf.com]
Microwaves Journal
Microwave Engineering Europe [microwave@electronics-eetimes.com]
analog@electronics-eetimes.com

**COURSE GUIDE** 2022/23

| | | | |
|---|---|---|---|
| **Faculty** | 345 - Faculty of Engineering - Bilbao | **Cycle** | Not Applicable |
| **Degree** | INTEL902 - Master in Telecommunication Engineering | **Year** | First year |

## COURSE

504006 - Design and Management of Telecommunications Networks and Services | **Credits, ECTS:** 9

## COURSE DESCRIPTION

The "Design and Management of Telecommunication Networks and Services" subject is one of the basic subjects of the 1st grade of the University Master in Telecommunication Engineering and it is located within the module named "Telecommunication Technologies". This subject deals with the techniques to design and deploy networks and services from the perspective of a telecom operator, including technical, operational, administrative, maintenance, management, marketing and legislative issues.

It is a common subject that addresses in an integrated way the whole spectrum of issues related to the management and planning of telecommunication networks and services. Therefore, this subject is tightly linked to the other subjects of the degree that study in detail specific issues related to data networks, specifically, "Convergence and Integration in Access and Backbone Networks" and "Internet: Advanced Concepts and New Services", both common subjects taught during the same grade as "Design and management of telecommunication networks and services". The former, "Convergence and Integration in Access and Backbone Networks", tackles issues related to the provision, management and operation of access and backbone networks, including the convergence and interoperability of heterogeneous networks. The latter, "Internet: Advanced Concepts and New Services", studies innovative routing technologies and telematics services to be supported in new generation networks.

In the same way, given its basic nature, this subject constitutes also a pillar for a better comprehension of the subjects corresponding to the speciality of Telematics Engineering taught during the 2nd grade of the University Master in Telecommunication Engineering, namely, "Design and Deployment of Telematics Infrastructures and Services", "Performance in Telecommunication Networks", "Advanced Telematics Technologies" and "Security and Distributed Services". In the first one, "Design and Deployment of Telematics Infrastructures and Services", the students apply different networking technologies and services developed in other subjects in order to deploy a testbed that integrates all the agents that interoperate in the provision chain of a service in a experimental environment. The second one "Performance in Telecommunication Networks", studies the mathematical modelling of networks and services for the performance analysis of telecommunication protocols and systems. The third one, "Advanced Telematics Technologies" covers the study of software architectures that allow the deployment of advanced services, and the necessary adjustments for the deployment in resource deprived devices in terms of computation, battery and/or communication. Finally, "Security and Distributed Services" studies topics related to the security, auditing and regulation of telematic applications, services and infrastructures.

To take "Design and Management of Telecommunication Networks and Services" without too much trouble, the students should master all the basic concepts related to the operation of data communication networks, including the characteristics of the basic parts of a communications system, the communications architecture stack models, the most relevant applications and protocols of each layer, the addressing schemas, etc.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacity to model, design, set up, manage, run, administer and maintain networks, services and contents.
Capacity to perform the planning, decision making and packaging of networks, services and applications taking into account the quality of service, the direct and operational costs, the implementation and monitoring plan, the security procedures, the escalation and maintaining, as well as to manage and guarantee the quality in the development process.
Knowledge, understanding and capacity to apply the necessary legislation in the course of the telecommunications engineering career

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

In order to gain the skills and reach the learning results previously described, the syllabus proposed for this subject consists of 5 modules or differentiated parts:

C11 block:
1) Operation and maintaining of networks and services:
- Networks and services management architectures. Basic concepts.
- Fundamentals of the network management.
- SNMP management model for TCP/IP networks.

- Other network management models.

C12 block:
2) Networks and services design and planning:
- Distributed data processing.
- Hierarchical network architectures.
- Information characterization.
- Capacity planning and network design.
- Network planning and assessment methodologies.

3) Telecommunications sector:
- History of the telecommunications sector and liberalization process.
- Legislative framework.
- Regulation and standardization bodies.
- Telecommunications market.

C21 block:
4) Access control mechanisms in telecommunications networks:
- Secure network design.
- Perimeter access control tools.
- Anti-malware tools.
- Tools for secure remote access.

5) Product commercialization strategies in the telecommunications sector:
- Basic marketing and digital marketing concepts.
- Business strategies in the telecommunications markets.
- Behavioural economics.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Classroom practicals | 37,5 | 40 % |
| Laboratory practicals | 75 | 40 % |
| Lectures | 112,5 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 45 | | 15 | 30 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 67,5 | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 45 % | 55 % |
| Delivery devices associated with ABP methodology | 20 % | 30 % |
| Practical tasks | 20 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the regular exam schedule, the subject is assessed by means of a continuous assessment method, which conform to the teaching methodologies used during the subject development. In fact, this subject combines two very different teaching methodologies: traditional methodology, based on mater classes; and Problem-Based Learning (PBL) methodology, based on the principles of cooperative active learning. Next, the assessment systems used in the regular exam schedule is detailed, according to the different modules of the subject:

Weight in the Final Grade / Module / Assessment Method
25% / Operation and maintaining of networks and services / TRADITIONAL: Exam + practice reports
25% / Networks and services design and planning / PBL: deliverables + exam
25% / Telecommunications sector / PBL: deliverables + exam
20% / Access control mechanisms in telecommunications networks / TRADITIONAL: Exam + practice reports

5% / Product commercialization strategies in the telecommunications sector / TRADITIONAL: Exam + practice reports

To pass the subject, students must obtain a minimum of 5 points over 10 as their final grade. Additionally, and as a requirement to compute the mean among the grades of the different parts, students must obtain a minimum of 4 points over 10 both in the part of the subject developed with PBL methodology as well as in the part developed with traditional methodology. The assessment of the part developed with traditional methodology will consist of an exam which will be carried out in three parts, in the corresponding official exam schedules of November, February and April. In the parts of the subject taught by means of PBL methodology, students must pass the corresponding exam in order to calculate the mean grade with the rest of the grades corresponding to deliverables.

The students that do not want to take the continuous assessment and want to be assessed by means of a final exam, must present to the lecturer responsible for the subject (marivi.higuero@ehu.eus) a written resignation to the continuous assessment. This must be done within the first 18 weeks of the subject, as it is detailed in the Students Evaluation Rules of the UPV/EHU.

Likewise, the students following the continuous assessment who want to resign regular exam schedule must present to the lecturer responsible for the subject (marivi.higuero@ehu.eus) a written resignation. To do this, students have a period of up to one month before the end date of the teaching period of the subject, in accordance with the academic calendar of the Faculty.

In the event that the sanitary conditions prevent the realization of any 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.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the special exam schedule, the subject assessment will consist of a final exam, being the score obtained in this exam the 100% of the subject’s grade.

## MANDATORY MATERIALS

Stallings, W., Case, T., “Business Data Communications. Infrastructure, Networking and Security”, Prentice Hall, 2013

## BIBLIOGRAFÍA

### Basic bibliography

Stallings, W., Case, T., "Business Data Communications. Infrastructure, Networking and Security", Prentice Hall, 2013

Stallings, W., "SNMP, SNMPv2, SNMPv3, and RMON1 and 2". 3rd Edition Addison-Wesley. 1999.

Mark A. Miller, "Managing Internetworks with SNMP", 3rd Edition. John Wiley & Sons. 1999.

Stewart, K., Adams, A., Reid, A., Lorenz, J., "Designing and Supporting Computer Networks, CCNA Discovery Learning Guide", Cisco Press, 2008

Grupo de Regulacion de las Telecomunicaciones (GRETEL), "GRETEL 98: Competencia y Regulación en los Mercados de las Telecomunicaciones, el Audiovisual e Internet", COIT, 1998.

Calzada, J., Costas, A., "La liberalización de las telecomunicaciones en España: control de la inflación y universalización del servicio", Universitat de Barcelona, 2013.

Kotler, P., Kartajaya, H., Setiawan, I., "Marketing 3.0: From Products to Customers to the Human", Wiley, 2010

### Detailed bibliography

Subramanian, M., "Network Management: Principles and Practice", Pearson, 2000.

Stallings, W, "SNMP, SNMPv2 and CMIP. The practical guide to Network Management Standards", Addison-Wesley, 1993.

Aidarous, S., Plevyak, T., "Telecommunications Network Management: Technologies and Implementations, IEEE Series on Network Management, Wiley, 1997.

Pras, A., "Network Management Architectures", CTIT, Ph. D-Thesis series No. 95-02.

Telecommunications Management Network (TMN), International Engineering Consortium (IEC), Web ProForum Tutorials, http://www.iec.org.

Lee, I., "Handbook of Research on Telecommunications Planning and Management for Business", 2-Volumes, IGI Global, 2009.

Evans, S., "Telecommunications Network Modelling, Planing and Design", IET, 2003.

Law, A. M., "Simulation modeling and analysis", 5th edition, Mc Graw-Hill, 2014.

Grodzinsky, F. S., "Networking and Data Communications Laboratory Manual", Prentice Hall, 1998.

Spohn, D. L., "Data Network Design", 3rd edition, McGraw-Hill, 2003.

Piliouras, T. C., "Network Design. Management and Technical Perspectives", 2nd edition, McGraw-Hill, 2005

Bidgoli, H., "Handbook of Computer Networks. Key Concepts, Data Transmission, and Digital and Optical Networks", John Wiley & Sons, Inc., 2008.

Sethi, A. S., Hnatyshin, V. Y., "The Practical OPNET User Guide for Computer Network Simulation", CRC Press, 2012.

Intven, H., Oliver, J., Sepulveda, E., "Telecommunications Regulation Handbook", ITU, 2000.

Malik, S., "Network Security Principles and Practices", Cisco Press, 2002.

Stallings, W., "Cryptography and Network Security: Principles and Practice", 5th edition, Prentice Hall Press, 2010.

**Journals**

TOTAL TELECOM http://www.totaltele.com/

La liberalización de las telecomunicaciones en España: control de la inflación y universalización del servicio, Joan Calzada y Antón Costas, Universitat de Barcelona, 2013.

INFORMES TÉCNICOS:

ITU-T Rec. Y. 2011, General Principles and General Reference Model for Next Generation Network, ITU-T, 2004.

Pras, A., van Beijnum, B. J., Sprenkels, R., Introduction to TMN, CTIT Technical Report 99-09, University of Twente, 1999.

INFORMES:

COIT, Grupo de políticas públicas y regulación, La gestión de derechos de propiedad intelectual en el entorno TIC, COIT, 2014.

COIT, Grupo de políticas públicas y regulación, Protección de datos y privacidad en el sector TIC, COIT, 2014.

ONTSI, Informe anual del sector TIC y de los contenidos en España, 2015.

ONTSI, La sociedad en red. Informe anual 2015, 2015.
ONTSI, Las TIC en los hogares españoles. Estudio de demanda y uso de Servicios de Telecomunicaciones y Sociedad de la Información, 2015.

**Web sites of interest**

European Commission. Information Society. eEurope 2005. An Information Society for all.
http://europa.eu.int/information_society/eeurope/2005/index_en.htm/

Comisión de Estudio para el Desarrollo de la Sociedad de la Información. http://cdsi.red.es/

Observatorio de las Telecomunicaciones y la Sociedad de la Información. http://observatorio.red.es/

M. TADAULT, S. SOORMALLY, and L. THIEBAULT, Network evolution towards IP multimedia subsystem, Alcatel, Tech. Rep., 2003, Madrid, España.
http://www.alcatel.com/doctypes/articlepaperlibrary/pdf/

ATR2003Q4/T0312-IP-Multimedia-EN.pdf

Opnet, Inc. http://www.opnet.com/

Tivoli http://ww.ibm.com/software/Tivoli/

CMT - Comisión del Mercado de las Telecomunicaciones". http://www.cmt.es/

ONF: https://www.opennetworking.org/

Total Telecom, http://www.totaltele.com/

Internet Society, http://www.internetsociety.org/

IETF, http://www.ietf.org/

IAB, http://www.iab.org/

IRTF, http://www.irtf.org/

IANA, http://www.iana.org/

ISO, http://www.iso.org/

IEC, http://www.iec.ch/

ITU, http://www.itu.int/

ETSI, http://www.etsi.org/

ANSI, http://www.ansi.org/

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504007 - Microelectronics
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

Basic knowledge about active electronic components, manufacturing processes and technologies in integrated circuits, as well as the use of design tools, mathematical models, analysis and simulation of electronic circuits.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para diseñar y fabricar circuitos integrados.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. INTRODUCTION TO THE INTEGRATED CIRCUITS.
1.1 Historical evolution of integrated circuits.
1.2 Classification of integrated circuits.

2. MANUFACTURING PROCESSES OF INTEGRATED CIRCUITS.
2.1 Manufacture of integrated circuits.
2.2 Semiconductor substrates. Obtaining monocrystalline silicon.
2.3 Growth of monocrystals. Preparation of the substrate.
2.4 Epitaxial growth. Diffusion of impurities. Ionic implantation.
2.5 Oxidation, deposition of insulators and polysilicon.
2.6 Lithography techniques. Metallization. Encapsulated

3. MOS TECHNOLOGY
3.1 NMOS logic.
3.2 CMOS logic.
3.3 Input and output circuits. Verification.
3.4 Advanced circuits in MOS technology.
3.5 Fundamentals of circuits with switched capacities.
3.6 CMOS logic gate circuits.

4. BIPOLAR TECHNOLOGY.
4.1 Manufacturing process of bipolar integrated circuits.
4.2 Diodes and transistors in bipolar integrated circuits.
4.3 Passive components in integrated circuits.
4.4 Bipolar Logics: TTL, ECL and I2L.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Classroom practicals | 7,5 | 40 % |
| Computer practicals | 37,5 | 40 % |
| Lectures | 67,5 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 27 | | 3 | | 15 | | | | |
| Horas de Actividad No Presencial del Alumno/a | 40,5 | | 4,5 | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 70 % | 70 % |

| | | |
|---|---|---|
| Practical tasks | 30 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation is composed of two parts:
A theory exam for the 70% of the final grade.
A practical laboratory exercise for the 30% of the final grade.
The subject is passed only provided that both parts have been passed separatly (Theory >35%, Laboratory > 15%).

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The same that in the ordinary call.

## MANDATORY MATERIALS

De Diego, J.M. y Jiménez, J., Circuitos Integrados. Notas docentes. Publicaciones ETSI
Software installed in the computer rooms(both, for classes and open access) DSCH v2.7f and Microwind v2.6k

## BIBLIOGRAFÍA

### Basic bibliography

Rabaey, J.M.; Chandrakasan, A.; Nikolic, B. Circuitos Integrados Digitales; Pearson Educación S.A.. 2004.

### Detailed bibliography

Neil H.E.; Weste and Kamran Esharaghina Principles of CMOS VLSI Design; Addison Wesley; 1993.
Paul R. Gray and Robert G. Meyer; Análisis y Diseño de Circuitos Integrados Analógicos; 3rd edition; Prentice Hall; 1993.
David A. Hodges and Horace G. Jackson; Analysis and Design of Digital Integrated Circuits; 2nd edition; MacGraw-Hill; 1988

### Journals

Electron Devices, IEEE Transactions on (ISSN: 0018-9383) Electron Device Letters, IEEE ISSN: 0741-3106

### Web sites of interest

http://bwrc.eecs.berkeley.edu/classes/icbook/spice www.microwind.org
www.cadence.com

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504010 - Convergence and Integration on Core and Access networks
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

This course examines the provision models and procedures for the management and operation of access and backbone networks.

After this course students should have general knowledge on how to solve the convergence, interoperability and design of heterogeneous networks.

In the event that sanitary conditions prevent the face-to-face teaching activity and/or assessment, online modalities will be made active and the students will be promtly informed.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para resolver la convergencia, interoperabilidad y diseño de redes heterogéneas con redes locales, de acceso y troncales, así como la integración de servicios de telefonía, datos, televisión e interactivos.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. INTRODUCTION
2.- ACCESS NETWORKS
Provision models, procedures for the management and operation of heterogeneous access networks.
3.- BACKBONE NETWORKS
Transport models based on packages.
Models for optical transport.
4.- CONTROL PLANE
Control architectures in Next Generation Networks.
5.- INTEGRATION OF ACCESS, BACKBONE AND CONTROL PLANE IN NGN
Models and integrative architectures in Next Generation Networks

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Seminars | 10 | 40 % |
| Laboratory practicals | 37,5 | 40 % |
| Lectures | 65 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 26 | 4 | | 15 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 39 | 6 | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 25 % | 60 % |
| Presentations | 10 % | 40 % |
| Practical tasks | 20 % | 50 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation of the course is designed to be done through continuous evaluation.

The final grade of the subject (with the continuous assessment) will be developed with the next grading formula:

*Lectures: 40% of the grade
Based on written exams
*Presentations: 20% of the grade
10% assigments developed in seminars
10% presentations related to practice
*Practical Tasks: 40% of the grade
*30% group reports
*10% continuous assesment in practical tasks

To pass the course, it is COMPULSORY to attend ALL continuous assessment classes (laboratory classes and seminars).

The student wishing to renounce the continuous evaluation will have to do so by submitting an email to the professor responsible for the asignature: eva.ibarrola@ehu.eus in 8 weeks from the beginning of the semester.

A minimum grade of 4 both is needed both in the theoretical part and in the practical part to pass the course.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The practical and theoretical contents will be evaluated through a final exam that will be 100% of the grade of the subject.

## MANDATORY MATERIALS

Official web site of the subject: https://egela.ehu.es/

## BIBLIOGRAFÍA

### Basic bibliography

- PETER TOMSU, CHRISTIAN SCHMUTZER, "NEXT GENERATION OPTICAL NETWORKS", ED. PRENTICE HALL, 2002
- C. HELLBERG, D. GREENE, AND T. BOYES, "BROADBAND NETWORK ARCHITECTURES: DESIGNING AND DEPLOYING TRIPLE-PLAY SERVICES", PRENTICE HALL PTR UPPER SADDLE RIVER, NJ, USA, 2007.
- A. KASIM AND P. ADHIKARI, "DELIVERING CARRIER ETHERNET: EXTENDING ETHERNET BEYOND THE LAN", MCGRAW-HILL OSBORNE MEDIA, 2007
- A. FARREL AND I. BRYSKIN, "GMPLS: ARCHITECTURE AND APPLICATIONS", MORGAN KAUFMANN, 2006.
- I. MINEI AND J. LUCEK, "MPLS-ENABLED APPLICATIONS: EMERGING DEVELOPMENTS AND NEW TECHNOLOGIES", WILEY, 2008.
- REDES CONVERGENTES, Manual ITU-T 2010.
- CONVERGING NETWORKS, Manual ITU-T 2010.
- CHRIS HELLBERG, DBROADBAND NETWORK ARCHITECTURES: DESIGNING AND DEPLOYING TRIPLE-PLAY SERVICES¿, PRENTICE-HALL 2007.
- JORDI PALET, IPv6 PARA ESPAÑA, CONSULINTEL 2011.
- A. FARREL E I. BRYSKIN, GMPLS: ARCHITECTURE AND APPLICATIONS, MORGAN KAUFMANN, 2006.
- KARTALOPOULOS, STAMATIOS, NEXT GENERATION INTELLIGENT OPTICAL NETWORKS: FROM ACCESS TO BACKBONE, SPRINGER, 2008.
- MIIKKA POIKSELKÄ, GEORG MAYER, THE IMS: IP MULTIMEDIA CONCEPTS AND SERVICES, WILEY, 2009.
- GONZALO CAMARILLO, MIGUEL-ANGEL GARCÍA-MARTÍN, THE 3G IP MULTIMEDIA SUBSYSTEM (IMS): MERGING THE INTERNET AND THE CELLULAR WORLD, 3ª EDICIÓN, WILEY 2008

### Detailed bibliography

- Broadband Network Architectures: Designing and Deploying Triple-Play Services; Naoaki Yamanaka, Kohei Shiomoto , Eiji Oki; Prentice Hall
- GMPLS Technologies: Broadband Backbone Networks and Systems (Optical Science and Engineering); Chris Hellberg, Dylan Greene, Truman Boyes ;CRC Press.
- Broadband Cable Access Networks: The HFC Plant (The Morgan Kaufmann Series in Networking), David Large and James Farmer, Morgan Kaufmann.

### Journals

IEEE Network: The Magazine of Global Internetworking, IEEE PRESS.

### Web sites of interest

Broad Band Forum: http://www.broadband-forum.org/
TeleManagementForum: http://www.tmforum.org/
UIT-T Recommendations: http://www.itu.int/en/publications/ITU-T/Pages/default.aspx

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504011 - Advanced Signal Processing
**Credits, ECTS:** 6

## COURSE DESCRIPTION

Establishes the basis of discrete random processes for the development of adaptive techniques applied to communications systems. It covers advanced channel coding techniques and digital modulations.

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 and the students will be promptly informed about it.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para aplicar métodos de la teoría de la información, la modulación adaptativa y codificación de canal, así como técnicas avanzadas de procesado digital de señal a los sistemas de comunicaciones y audiovisuales.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

BLOCK 1: RANDOM SEQUENCES
Topic 1 Discrete random processes
Topic 2 Stationary processes
Topic 3 Ergodic stationary processes
Topic 4 Process Modeling

BLOCK 2: ADAPTIVE PROCESSING IN COMMUNICATIONS
Topic 5 Linear Prediction
Topic 6 Optimal Filtering: Wiener Filtering
Topic 7 Adaptive filtering
BLOCK 3: ADVANCED MODULATION TECHNIQUES
Topic 8: Channel coding: block and convolutional codes
Topic 9: Band-limited channel modulations

Seminars
Sem. 1: Deterministic Signals and Systems
Sem. 2: Basic principles of Convolutional Coding and Modulation.

Laboratory practicals
P1: Handling of signals and systems in Matlab.
P2: Random variables. Non-stationary random processes.
P3: Stationary processes and ergodic processes.
P4: Random processes through SLI
P5: Linear prediction applied to speech coding.
P6: Optimal decoding of convolutional systems
P7: Decoding band-limited systems
P8: Optimal filtering: Wiener FIR filtering
P9: Applications of adaptive filtering I
P10: Adaptive filtering applications II

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Seminars | 12,5 | 40 % |
| Laboratory practicals | 56,25 | 40 % |
| Lectures | 81,25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 32,5 | 5 | | 22,5 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 48,75 | 7,5 | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Continuous evaluation | 10 % | 60 % |
| Written examination | 40 % | 90 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The final evaluation is based on two grades:
1. Theory grade, which is obtained through a written exam of the part corresponding to the theoretical classes (60% of the total).
2. Practice grade, which corresponds to the practical part of the course (40% of the total). It is distributed as follows:
- Individual practical exam (30% of the total)
- Evaluation of the reports presented jointly (10% of the total).

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary call, the evaluation scheme of the ordinary call is maintained, with two tests:
1. Theory grade (written exam of the part corresponding to the theoretical classes, 60% of the total).
2. Practical grade (individual practical exam, corresponding to the practical part of the course, 40% of the total).

## MANDATORY MATERIALS

## BIBLIOGRAFÍA

### Basic bibliography

Material developed by the professors available in eGela (http://egela.ehu.es/)2 including:
- Course notes (topics 1-7).
- Problems of the course.
- Support material for seminars.
- Scripts of the laboratory practices.

### Detailed bibliography

J.G. Proakis, Advanced digital signal processing, Prentice Hall
B. Widrow, S.D. Stearns, Adaptive signal processing, Prentice Hall
S. Haykin, Adaptive Filter Theory, Prentice Hall
Stephen P. Wilson Digital Modulation and Coding Prentice Hall, 1996
John G. Proakis and Masoud Salehi, Digital Communications 5ed. McGrawHill International 2008.

### Journals

IEEE Transactions on Communications
IEEE Transactions on Information Theory
IEEE Communications Magazine

### Web sites of interest

www.complextoreal.com
http://www.dsprelated.com/
Modulation and coding:
http://www.educatorscorner.com/experiments/spectral/SpecAn10.shtml
http://dbserv.maxim-ic.com/tarticle/view_article.cfm-article_id=70

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504014 - Digital Circuit Laboratory
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

Laboratory of digital circuits is a subject of the course 1 semester 2 within the "Master's Degree in Telecommunication Engineering". The teaching is done in the School of Engineering. In this subject the field programmable circuits (FPGA) are worked on and in particular the devices that combine a programmable part and microprocessor (SoPC). It provides the knowledge and tools to analyze, design and use programmable circuits: characteristics, technological evolution, programmable logic devices, circuit description in VHDL and programming in C. The postgraduate course is supported (mainly) in the following subjects of the degree in telecommunication engineering:
* Course 2: Digital Electronics
* Course 3: Digital Systems
* Course 4: Digital circuits laboratory (optional)
The concepts, technologies and processes studied in this subject serve as support for subjects such as:
* Electronic communications systems
* Advanced signal processing
* Design and management of telecommunication networks and services
* Processing of biomedical signals

In the event that health conditions prevent the completion of a teaching activity and / or evaluation in person, it will activate a mode of non-presence of which students will be informed promptly.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocimiento de los lenguajes de descripción hardware para circuitos de alta complejidad.
Capacidad para utilizar dispositivos lógicos programables, así como para diseñar sistemas electrónicos avanzados, tanto analógicos como digitales. Capacidad para diseñar componentes de comunicaciones como por ejemplo encaminadores, conmutadores, concentradores, emisores y receptores en diferentes bandas.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Classroom:
During the classes in the classroom, we will see different coding techniques as well as the problems that may arise in the advanced design of FPGAs. The content of the theory must be applied in the IP cores that will be designed in the laboratory:

* Class Intro and 7 Series Architecture Overview
* FPGA Design Methodology and HDL Coding Techniques
* Synchronous Design Techniques and Reset Methodology
* Synchronization Circuits
* FPGA Design Techniques and Timing Exceptions
* Zynq Architecture
* Introduction to AXI and Zynq PS-PL AXI Ports

Laboratory
* FPGA Design Flow using Vivado
These practices will provide students with an introduction to the design flow using the Vivado® Design software suite for the Xilinx All Programmable devices.
The documentation for this course can be found on the Xilinx University Program website as well as on the subject page.

* Embedded System Design Flow on Zynq using Vivado
This course provides students with an introduction to the design of Zynq embedded systems using a Zedboard and Vivado board.
The documentation for this course can be found on the Xilinx University Program website as well as on the subject page.

* IP core design
Realization of free final practice. Creation of an IP core with interconnection using standard buses for real-time audio processing configurable using software.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Lectures | 30 | 50 % |
| Laboratory practicals | 82,5 | 36 % |

## 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 | 15 | | | 52,5 | | | | | |

**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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 25 % | 50 % |
| Practical tasks | 50 % | 75 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

One or more exams whose weighted average corresponds to 100% of the written test grade.
Final project for 100% of the part corresponding to the project.
The resignation must be done following the current regulations.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Examen práctico por el 100% de la asignatura

## MANDATORY MATERIALS

* L. H. Crockett, R. Elliot, M. Enderwitz. "The Zynq Book: Embedded Processing with the Arm Cortex-A9 on the Xilinx Zynq-7000 All Programmable Soc".ISBN 9780992978709. Strathclyde Academic Media. http://www.zynqbook.com/
* Surviving the SOC revolution : a guide to platform-based design. Chang, Henry, Kluwer Academic, 1999.
* Winning the SoC revolution : experiences in real design. Martin, Grant, Kluwer Academic, 2003.
* Xilinx University Program: http://www.xilinx.com/support/university/students.html
* Zynq-7000 SoPC Documentation: http://www.xilinx.com/products/silicon-devices/soc/zynq-7000.html

## BIBLIOGRAFÍA

### Basic bibliography

* Clive "Max" Maxfield. "The Design Warrior's Guide to FPGAs". Ed. Newnes, 2004.
* Pong P. Chu. "RTL Hardware Design Using VHDL: Coding for Efficiency, Portability, and Scalability". Ed. Wiley- IEEE Press, 2006.
* L. H. Crockett, R. Elliot, M. Enderwitz. "The Zynq Book Tutorials for Zybo and ZedBoard". ISBN 9780992978730, Strathclyde Academic Media
* J. L. Martín (coordinador), P. Ibáñez, A. Zuloaga, U. Bidarte, J. Arias y J. Lázaro. "Electrónica digital". ISBN 84-96477-44-4. 2006, Delta Publicaciones, Madrid.
* E. Mandado, J. L. Martín. "Sistemas electrónicos digitales". ISBN 9788426721983, Ediciones Marcombo

### Detailed bibliography

IEEE Std 1076-1993. "IEEE Standard VHDL Reference Manual". Junio de 1994.
Volnei A. Pedroni. "Circuit Design with VHDL". Ed. MIT Press, 2004.
Sunggu Lee. "Advanced Digital Logic Design Using VHDL, State Machines, and Synthesis for FPGA's". Ed. Thomson-Engineering, 2005.

### Journals

### Web sites of interest

http://www.xilinx.com
http://www.digilentinc.com
http://www.ehu.es/Electronica_EUITI/vhdl/pagina/inicio.htm
http://www.vhdl-online.de/tutorial/
http://esd.cs.ucr.edu/labs/tutorial/

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504015 - Internet: Advanced Concepts and New Services
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

The subject will allow the student to learn the most important characteristics of the most innovative routing technologies used in various Internet scenarios, as well as the telematics services for the new generation networks.

In the event that the sanitary conditions prevent the realization of any 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.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad de comprender y saber aplicar el funcionamiento y organización de Internet, las tecnologías y protocolos de Internet de nueva generación, los modelos de componentes, software intermediario y servicios.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. INTRODUCTION TO THE MOST ADVANCED ASPECTS OF ROUTING IN THE INTERNET
2. MOBILITY AND MULTIHOMING
3. MULTICAST
4. ADVANCED ASPECTS OF IPV6
5. NEW SERVICES IN NEW GENERATION NETWORKS

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Seminars | 10 | 40 % |
| Individual work and/or group work | 10 | 40 % |
| Laboratory practicals | 37,5 | 40 % |
| Computer work practice, laboratory, site visits, field trips, external visits | 37,5 | 40 % |
| Lectures | 65 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 26 | 4 | | 15 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 39 | 6 | | 22,5 | | | | | |

**Legend:**
M: Lecture-based
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GO: Applied computer-based groups
GCL: Applied clinical-based groups
TA: Workshop
TI: Industrial workshop
GCA: Applied fieldwork groups

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 50 % | 60 % |
| Otros | 15 % | 30 % |
| Practical tasks | 15 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The total score of the subject breaks down as follows:
60% of the total score: assessment of the written exam about all the lectures.
20% of the total score: assessment of the laboratory work and deliverables. Attendance, attitude and participation.
20% of the total score: Others. Evaluation and presentation of seminar deliverables. Attendance, attitude and participation.
To pass the course in the ordinary call following the described evaluation method, it is necessary that the weighted average of the qualifications of the sections described above is greater than 5 points and that, in any case, the mark in the

exam is greater or equal to 4 points out of 10.
For resignations, the ordinary regulations of the university will be applied

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

A single exam for 100% of the subject.
For resignations, the ordinary regulations of the university will be applied.

## MANDATORY MATERIALS

Halabi, S. Internet Routing Architectures (2nd Edition). Cisco Press. 2000.

## BIBLIOGRAFÍA

### Basic bibliography

Abdul Sakib Mondal. Mobile IP: Present State and Future. Series in Computer Science. 2006
Wittmann, R.; Zitterbart, M. Multicast Communication: Protocols, Programming, & Applications. The Morgan Kaufmann Series in Networking. 2000.
Hagen, S. IPv6 Essentials. O'Reilly. 2006.

### Detailed bibliography

Grundemann , C. Day One: Exploring IPv6. Juniper Network Books. 2011.

### Journals

Journal of Network and Computer Applications, Elsevier
Computer Networks, Elsevier
Mobile Networks and Applications, Springer

### Web sites of interest

http://www.garr.it/emc_training/tutorials/mcast_tutorial.pdf
http://www.nanog.org/meetings/nanog44/presentations/Monday/SmithBonica_IPv6_N44.pdf
http://www.net2.uni-tuebingen.de/fileadmin/RI/teaching/mobilecomm/ws0607/Williams2.pdf
http://www.javvin.com/protocol/rfc3344.pdf
http://www.ietf.org/rfc/rfc3775.txt

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504018 - Advanced Radio Communications Design
**Credits, ECTS:** 7,5

## COURSE DESCRIPTION

This course focuses on the design and planning of several radio communication systems such as: backbone and access networks, mobile communications networks, satellite communications, radar systems and radionavigation systems.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para desarrollar sistemas de radiocomunicaciones: diseño de antenas, equipos y subsistemas, modelado de canales, cálculo de enlaces y planificación.
Capacidad para implementar sistemas por cable, línea, satélite en entornos de comunicaciones fijas y móviles.
Capacidad para diseñar y dimensionar redes de transporte, difusión y distribución de señales multimedia.
Capacidad para diseñar sistemas de radionavegación y de posicionamiento, así como los sistemas radar.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

Lectures and seminars.

- Topic 1. Advanced propagation theory. Review of free space propagation and radiant systems. Channel models and propagation models. Problems.

- Topic 2. Radiocommunications for fixed services. Review of radio links. Short review of SDH and PDH. Canalization. Unavailability and error characteristic issues. Problems.

- Topic 3. Mobile radiocommunications. Review of fundamentals of mobile communications. LTE case study: beamforming, MIMO and spectral efficiency. Problems.

- Topic 4. Satellite radiocommunications. Review of satellite communications fundamentals. Mobile satellite services, satellite broadcasting. Problems.

- Topic 5. Radar and radionavigation systems. Review of fundamentals and design of radar systems. Geolocation services. Problems.

Laboratory projects.

- Project 1. Measurements automation. Introduction to the SW for equipment remote control. Development of a control software to carry out a measurement campaign and subsequent analysis. Result presentation.

- Project 2. Introduction to simulation SW. Antenna design Case study: design and simulation of microstrip antennas. Result presentation.

- Project 3. Measurement of RF signals and characterization of circuits using the S parameters. Propagation models and introduction to basic channel modeling. Measurement of channel impulse and frequency response; propagation speed. Planning and execution of indoor measurement campaign; Data processing and conclusions about the radio channel. Result presentation.

- Project 4. LTE network simulation. Tutorial and general coverage objectives for the development of the network. Result presentation.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|

| | | |
|---|---|---|
| Seminars | 37,5 | 40 % |
| Lectures | 37,5 | 40 % |
| Analytical problems - working groups (report) | 37,5 | 40 % |
| Laboratory practicals | 112,5 | 40 % |
| Computer work practice, laboratory, site visits, field trips, external visits | 112,5 | 40 % |

## TYPES OF TEACHING

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

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 40 % | 40 % |
| Presentations | 30 % | 30 % |
| Multiple-choice examination | 30 % | 30 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Mid-course exam: NO.

Clarification of the assessment system:

1) On-going assessment.
There will be a written exam the day of the first official call regarding the contents of the lectures and the seminars. In this first exam, worth a 40% of the final grade of the course, a minimum grade of 3.5 points over 10 will be required to pass the course. Should this requirement not be fulfilled, the final grade will be the grade obtained in this exam of lectures and seminars.
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.
The remaining 60% is assigned to the laboratory projects. The skills to be acquired in these projects are assessed following two procedures:

a) There will be oral presentations by the working groups of the laboratory about the work carried out in the projects with a weight of 30% of the final grade of the course. Each project will be given a 0-to-10 grade, and each grade will determine a 7.5% of the final grade of the course, so that, being 4 projects, the overall grade provided by this assessment procedure will be the mentioned 30%.
More specifically, half of the groups will present projects 1 and 3, while the other half will present projects 2 and 4. 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, might be used for this evaluation.
The working groups that are not to do the oral presentation in a certain project will have to develop a presentation-format report from the scratch for that project. However, they will be allowed to take information from the document already presented by other group and amend it or improve it, taking into consideration the questions and comments arisen in the question time. This document will be used for the evaluation of this project for each non-presenting group.
For this procedure to work properly, the composition of the working groups should be kept constant along the course.

b) Test exam regarding the laboratory projects with 3 to 5 questions corresponding to each project for an overall number of 20 questions. The weight of this exam will be 30% of the final grade of the course.

2) Not on-ongoing assessment.
In order to relinquish the on-going assessment, a letter must be sent to the subject coordinator following the procedure and within the time limits defined by the University regulations. As a consequence, it will be possible to obtain the maximum grade by means of the written exam of the contents of the lectures, the seminars and the laboratory projects,

with the following distribution: lectures and seminars will have a weight of 40% of the final grade of the course, while laboratory projects will be assigned the remaining 60%. In the first part, the one corresponding to lectures and seminars, a minimum grade of 3.5 points over 10 will be required to pass the course. The laboratory part will be a 30-question test with there being no minimum requirement of grade in this part in order to pass the course.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Even though the evaluation format is the same as in the first call, the laboratory test for the not on-going assessment will have 20 questions.

## MANDATORY MATERIALS

- Course slides and exercises based on practical scenarios to be solved, available on the online platform (eGela)
- Guides of the Laboratory Projects (also available on eGela) and reference material.

## BIBLIOGRAFÍA

### Basic bibliography

- Radio Regulations. International Telecommunication Union - Radio Sector, ITU-R. Geneva 2008.
- ITU-R Recommendations. Radiocommunication Sector, Series: F, M, PI, PN, S, SF, SM, V. International Telecommunication Union. Geneva 2008.
- John S. Seybold. Introduction to RF propagation. John Wiley & Sons, Inc. 2005.
- Robert K. Crane. Propagation handbook for wireless communication system design. CRC Press LLC, 2003.
- Satellite Communications Systems Engineering. Louis J. Ippolito, Jr. Ed. John Wiley & Sons Ltd, 2008

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ITU-R Recommendations. Radiocommunication Sector, Series: F, M, PI, PN, S, SF, SM, V. International Telecommunication Union. Geneva 2008.
Stuzman, Warren. Antenna Theory and Design. John Wiley and Sons, 1981.
Cellular Radio Performance Engineering. A. Mehrotra. Ed. Artech House 1994.
Understanding UMTS RADIO NETWORK, Modelling, Planning and Automated Optimisation. John Wiley and Sons, 2006.
Radio Network Planning and Optimisation for UMTS. Jaana Laiho y Achim Wacker. Ed. John Wiley & Sons Ltd, 2006
OFDM for Wireless Multimedia Communications. R Van Nee, R Prasad , 2000.
Synchronization and Channel Estimation in OFDM Systems. JJ van de Beek , 1998.
K. F. Sander, "Microwaves Components and systems", Addison-Wesley, 1987
Bahl I. "Microwave Solid State Circuit Design"- John Wiley & Sons
Introduction to Radar Systems, M.I. Skolnik, McGraw-Hill Book Co., Singapur, 1980
Radar System Analysis and Modeling, D. K. Barton, Artech House , 2005
A software-defined GPS and Galileo Receiver - A single-frequency approach, K. Borre, D.M. Akos, N. Bertelsen, P. Rinder, S.H. Jensen, Birkhäuser , 2007

### Journals

IEEE Transactions on Communications
IEEE Transactions on Vehicular Technology
IEEE Transactions on Broadcasting
IEEE Antennas and Wireless Propagation Letters

### Web sites of interest

http://www.itu.int
http://www.ebu.ch
http://www.etsi.org
http://www.dvb.org
http://www.umts-forum.org
http://www.3gpp.org
http://ieeexlpore.ieee.org
http://www.esa.int/esaNA/galileo.html
http://www.gps.gov

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** First year

## COURSE

504022 - Research Management and Methodology
**Credits, ECTS:** 3

## COURSE DESCRIPTION

This subject seeks to introduce the student to the research methodology, providing the conceptual and practical tools necessary to achieve effective development of their research tasks.
This subject covers the basis of the scientific method and the main activities to carry out by a person who intends to develop scientific and / or technological research and work in the field of R + D + i in any of its aspects. With this aim, the following topics are studied: scientific publications, doctoral theses, congresses and technical conferences, patents, spinoffs and incubators, the transfer of scientific and technological knowledge to the production environment, the information search, the preparation of proposals for research projects, certification of R + D + i projects and oral communications. Other issues such as fraud, error, bias, philosophy of science, and research ethics are also addressed.
This subject allows the student to acquire not only technical knowledge about the described specific topics, but by carrying out practical work that reproduces real activities, the student acquires the skills and knowledge required to carry out R & D & i activities in a company, university or research center.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para la integración de tecnologías y sistemas propios de la Ingeniería de Telecomunicación, con carácter generalista, y en contextos más amplios y multidisciplinares como por ejemplo en bioingeniería, conversión fotovoltaica, nanotecnología, telemedicina.
Capacity for the elaboration, direction, coordination, and technical and economic management of projects on: systems, networks, infrastructures and telecommunication services, including the supervision and coordination of the partial projects of its attached work; common telecommunication infrastructures in buildings or residential centers, including digital home projects; telecommunication infrastructures in transport and environment; with its corresponding power supply facilities and evaluation of electromagnetic emissions and electromagnetic compatibility.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

At the end of the subject, students must have acquired the skills described, as well as the expected learning outcomes. These learning outcomes are as follows:
- Develop a project working as a team.
- Ability to carry out tasks of preparing requests for research projects developing the fundamental knowledge of the research methodology.
- Understand the procedures and basic techniques to carry out research work.

## CONTENIDOS TEÓRICO-PRÁCTICOS

1. Fundamental concepts about scientific research: The researcher and the research process. The cientific method.
2. Scientific publications and documentation.
3. The doctoral thesis.
4. Research projects: calls and regional, state and European research plans. Proposal and evaluation of research projects. Development and monitoring.
5. Information search. Scientific databases.
6. Patents. Incubators for technology-based companies and spinoffs.
7. Transfer of knowledge to the productive environment. Policies and indicators.
8. Research Ethics. Fraud.
9. Introduction to the philosophy of science. Racism, sexism and other impostures.
10. Certification of research projects in companies. Scholarships and grants. Research career.
11. Science, technology and religion. Historical evolution and current situation.
12. Uncertainty, measurements and metrology.
13. Oral communication, congresses and conferences. Practical cases.
14. Presentation of research project proposals. Evaluation of research projects. Practical cases.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Computer practicals | 37,5 | 40 % |
| Lectures | 37,5 | 40 % |

## TYPES OF TEACHING

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

**Legend:**
M: Lecture-based
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GCL: Applied clinical-based groups
TA: Workshop
TI: Industrial workshop
GCA: Applied fieldwork groups

## Evaluation tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Continuous evaluation | 20 % | 40 % |
| Practical tasks | 60 % | 80 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the regular exam schedule, the evaluation system consists of two parts: written exam of the contents or the whole subject (35% of the grade) and 2 practical works (65% of the grade).

The distribution of 65% of the grade related to practical works in the different activities carried out in the subject is detailed below:

- Writing and presenting a research project proposal: 35%
- Creating and presenting an informative video about general telecommunication concepts: 30%

The evaluation process includes both individual and group work evaluation.

To pass the subject in the regular exam schedule following the described evaluation method, it is necessary that the weighted average of the grades of the sections described above is greater than 5 points and that in any case, the mark of the written exam is greater than or equal to 4 points out of 10.

Attending seminars is obligatory.

Students who do not wish to take continuous assessment must present their withdrawal from continuous assessment according to the procedure and deadlines established in Article 8.3 of the UPV / EHU Student Assessment Regulations.

NOTE: if health reasons do not allow a teaching activity or evaluation task to take place face-to-face, a not face-to-face modality will be used and students will be informed punctually.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the special exam schedule, the assessment will consist of a final exam, the score obtained in this exam being 100% of the subject’s grade.
Withdrawals will be carried out according to applicable regulations.

## MANDATORY MATERIALS

S. Ramón y Cajal: Reglas y consejos sobre la investigación científica. 1935.
J. R. Taylor: An introduction to error analysis. University Science Books, 1982.
C. Ascheron and Angela Kitkuth, "Make your mark in Science", Wiley, 2005
E. E. Glavich, R. R. Ibáñez, M. R. Lorenzo, H. A. Palma: Notas introductorias a la filosofía de la ciencia. Eudeba, 1998.
C. Sagan: El mundo y sus demonios, Editorial Planeta, 2000.
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Michael Shermer, "¿Por qué creemos en cosas raras?", Alba, 2002.
Decartes, R., "Discurso del Método", Alianza editorial, (Libro de bolsillo, sección clásicos),1987.
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Primo Yúfera, E., "Introducción a la investigación científica y tecnológica", Alianza editorial, 1994.
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B. Russel, Historia de la filosofía occidental, Austral, 2007, Tomos I y II
F. Di Trocchio: Las mentiras de la ciencia. Alianza editorial, 1769, 1995.
F. Di Trocchio: El genio incomprendido. Alianza editorial, CT 2501, 1999.
R. P. Feynman: ¿Qué significa todo eso?. Editorial Crítica, 1999.
R. P. Feynman: El placer de descubrir. Editorial Crítica, 2000.
J. Losee: Introducción histórica a la filosofía de la ciencia. Alianza editorial, AU I65, 1985.
A. Pestaña, "Veinticinco años de ciencia y técnica en España: Institucionalización e infraestructuras", Investigación y Ciencia, Septiembre, 2001.
How to write a thesis - Rowena Murray , 2006
Writing for Academic Journals - Rowena Murray, 2009
How to Survive Your Viva - Rowena Murray, 2009

**Detailed bibliography**

Davis, P. "La mente de Dios", McGraw Hill, 1993.
Francis S. Collins, "Cómo habla Dios", Temas de Hoy, Planeta, 2007.
Leonard Susskind, "El paisaje cósmico", Drakontos, 2007.
Richard Dawkins, "Evolución", Espasa Calpe, 2009
Richard Dawkins, "El espejismo de Dios", Espasa Calpe, 2007
S. Pérez: Cómo elaborar y presentar un trabajo escrito. Edición Deusto, S.A.,1993.
E. Currás: Documentación y metodologías de la investigación científica. Cuadernos de trabajo. Editorial Paraninfo,1995.
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A. Fernández-Rañada: Los científicos y Dios. Ediciones Nobel, 2000.
C. Allégre: Dios frente a la ciencia. Ediciones Península, 2000
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JOURNAL OF MANAGEMENT INFORMATION SYSTEMS, M E SHARPE INC
INTERNATIONAL JOURNAL OF SOCIAL RESEARCH METHODOLOGY BY ROUTLEDGE
ACADEMY OF MANAGEMENT JOURNAL
INTERNATIONAL JOURNAL OF RESEARCH & METHOD IN EDUCATION BY ROUTLEDGE
COMPUTERS & OPERATIONS RESEARCH BY ELSEVIER
NATURE
SCIENCE

**Web sites of interest**

Magazine "El Escéptico", edita ARP- Sociedad para el avance del pensamiento crítico: http://www.arp-sapc.org
Página del Ministerio de Educación: www.mec.es.
Página del Centro Español de Metrología: www.cem.es.
Servicio de Información Comunitario sobre Investigación y Desarrollo: http://cordis.europa.eu.int/es/home.html.
FECYT http://www.accesowok.fecyt.es/cursos/online.html
On being a scientist; a guide to responsible conduct in research,The national Academic of Science, The national Academic of Engineering and the Institue of Medicine (USA); http://www.nap.edu/catalog.php?record_id=12192
Nature Journal, http://www.nature.com/nature/index.html
Science magazine, http://www.sciencemag.org/

**COURSE GUIDE** 2022/23

**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** Second year

## COURSE

504026 - Speech Technologies
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

The subject is a general introduction to speech technologies and its goal is to qualify the student to work in this area. This includes both the research profiles and the professional profiles devoted to the design, development and commercialization of dialogue, speech synthesis and recognition systems, biometric security systems, etc. In this subject, basic concepts of signal processing taught in the in the Telecommunication Technology Engineering degree, mainly in the subject of Signal Treatment and also in Multimedia Signal Processing, where basic techniques to process audio and speech signals are studied. Besides, knowledge in advanced signal statistical processing is required. This topic is studied in Advanced Signal Processing, in the first course of the master.
In the event that the sanitary conditions prevent the realization of teaching activities and/or face-to-face evaluations, an online modality will be activated and the students will be informed promptly.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Conocer e interpretar los procesos de generación y percepción de la voz humana.
Comprender e interpretar los principales parámetros utilizados en la representación de la señal de voz
Conocer las estrategias fundamentales empleadas en los sistemas de síntesis y de codificación de la señal de voz, manejando las herramientas informáticas básicas para el procesado y tratamiento de la señal de voz.
Comprender la terminología empleada en el campo del tratamiento de la señal de voz, de forma que sea capaz de interpretar un trabajo de investigación descrito en una revista

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Describe the processes of generation and perception of the voice signal.
Demonstrate knowledge about the time and frequency representation of the voice signal and the techniques used for its analysis.
Demonstrate understanding of problems related to speech acoustic modeling, language modeling, automatic speech and speaker recognition, and voice synthesis systems, as well as about the techniques used to evaluate them.
Measure and interpret the main parameters that characterize the speech signal.
Implement a perceptual voice encoder.
Develop a basic speech recognition system.

## CONTENIDOS TEÓRICO-PRÁCTICOS

Lesson 1 Introduction to speech technologies
Lesson 2 Speech generation and perception
Lesson 3 Speech signal digital processing techniques
Lesson 4 Speech conding
Lesson 5 Introduction to speech and speaker recognition
Lesson 6 Text to speech conversion

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Laboratory practicals | 56,25 | 40 % |
| Lectures | 56,25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 22,5 | | | 22,5 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 33,75 | | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Written examination | 30 % | 70 % |

| | | |
|---|---|---|
| Practical tasks | 30 % | 70 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation is divided in three independent parts: master lessons, lab practices and a group work.
- The knowledge about the master lessons will be proven with a multiple choice 20 question test (40%).
- The lab practices will be evaluated by the reports and the work developed at the lab (45%).
- The group work will be evaluated by means of a group grade that will take into account the development and presentation of the work (15%).

In the regular evaluation, the exam must be passed with almost a 4 over 10 and to succeed in the subject the final grade of 5 over 10 must be achieved, once the grades gotten in the three parts are added up. The three parts are independent and once a part is passed, the grade is kept for future calls.

The students unable to follow the combined evaluation must justify their reasons with proper documentation sent to the subject lecturers, according to the procedure established by the current regulation in the first two weeks of the course. They also should inform the faculty at least a month before the exam period starts. These students will be able to prove the achievement of the learning results by means of a final evaluation consisting of: a written exam (40%), a laboratory exam (45%) and the developemnt and presentation of a work (15%).

By not showing to the final written exam, the student refuses to take part in the call.

In the event that the sanitary conditions prevent performing a teaching activity and/or face-to-face evaluation, a non-face-to-face modality will be activated. Students will be informed on time about it.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

In the extraordinary call, two different tests will be made: an exam for the master classes and another one for the lab practices. Each exam will represent the 50% of the final note and both of them must be passed with at least a 5 over 10.

The students that have presented the written justification to elude the continuous evaluation must prove they have correctly completed the lab practices.

In the event that the sanitary conditions prevent performing a teaching activity and/or face-to-face evaluation, a non-face-to-face modality will be activated. Students will be informed on time about it.

## MANDATORY MATERIALS

The students will have available at eGela (http://egela.ehu.eus/) the following materials, needed to correctly follow the course:
- Slides with the theoretical content of the course
- Guide for lab practices, a file for each practice with the corresponding theoretical introduction
- Necessary signals, matlab programs, linux scripts and other tools needed to complete the lab practices
- Guide for the development of the group research work

## BIBLIOGRAFÍA

### Basic bibliography

- J. G. Proakis, D. G. Manolakis. Digital signal processing. Principles, algorithms and applications (4th edition). Pearson Prentice Hall, 2007. (ISBN: 978-0131873742)
- L. R. Rabiner, R. W. Schafer. Digital processing of speech signal. Prentice-Hall, 1978. (ISBN: 978-0132136037)
- X. Huang, A. Acero, H. Hon. Spoken Language Processing: A Guide to Theory, Algorithm and System Development. Prentice Hall, 2001. (ISBN: 978-0130226167)
- A. V. Oppenheim, R. W. Schafer. Discrete-Time signal processing (3rd edition). Pearson Prentice Hall, 2009. (ISBN: 978-0131988422)
- D. Jurafsky, J. H. Martin. Speech and Language Processing (2nd edition). Prentice Hall, 2008. (ISBN: 978-0131873216)

### Detailed bibliography

- P. Taylor. Text-to-Speech Synthesis. Cambridge University Press, 2009. (ISBN: 978-0521899277)
- L. Rabiner, B. H. Juang. Fundamentals of Speech Recognition. CRC Press, 1993. (ISBN: 978-0130151575)
- D. Yu, L. Deng. Automatic Speech Recognition: A Deep Learning Approach. Springer, 2015. (ISBN: 978-1447157786)

- W. C. Chu. Speech Coding Algorithms: Foundation and Evolution of Standardized Coders. Wiley-Interscience, 2003. (ISBN: 978-0471373124)

**Journals**

Computer Speech and Language
Speech Communication
IEEE Transactions on Audio, Speech & Language Processing
IEEE Transactions on Systems, Man and Cybernetics-Part B
IEEE Transactions on Multimedia
Journal of the Acoustical Society of America

**Web sites of interest**

- Speech Technologies
http://www.speech.cs.cmu.edu/
http://festvox.org/
- Review of Speech Synthesis Technology
http://www.acoustics.hut.fi/publications/files/theses/lemmetty_mst/contents.html
- Speech Technology Hyperlinks Page
http://www.speech.cs.cmu.edu/comp.speech/Section5/speechlinks.html
- Smithsonian Speech Synthesis History Project (SSSHP)
https://amhistory.si.edu/archives/speechsynthesis/ss_home.htm
- TTS demos
https://www.acapela-group.com/demos/
http://www.nuance.com/landing-pages/playground/Vocalizer_Demo2/vocaLizer_modal.html?demo=true
http://www.cepstral.com/en/demos
https://cloud.google.com/text-to-speech
http://aholab.ehu.eus/tts
- ASR demos
https://speech-to-text-demo.ng.bluemix.net/
https://www.google.com/intl/en/chrome/demos/speech.html

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**Faculty** 345 - Faculty of Engineering - Bilbao
**Cycle** Not Applicable
**Degree** INTEL902 - Master in Telecommunication Engineering
**Year** Second year

## COURSE

504027 - Biomedical Signal Processing
**Credits, ECTS:** 4,5

## COURSE DESCRIPTION

BIOMEDICAL SIGNAL PROCESSING

DESCRIPTION AND CONTEXTUALIZATION

The subject is an introduction to the analysis and digital processing of biomedical signals of different nature. Typical one-dimensional signals such as the electrocardiogram (ECG), the electroencephalogram (EEG) and the electromyogram (EMG), and multidimensional signals, such as biomedical images, are introduced.

The student will learn to interpret the physiological phenomenon represented by the signals, the acquisition and conditioning techniques that allow the digital storage of the signals, as well as techniques aimed to characterize these signals in the time and in the frequency domains. Typical applications of biomedical signal processing, mainly oriented to diagnosis, will be developed during the laboratory sessions.

The subject is conceived as a general introduction to the biomedical engineering discipline. Thus, it introduces the professional skills required for a biomedical engineer, such as maintenance, design and commercialization of electromedical equipment, diagnostic devices, and medical image systems. The subject also introduces some topics related to research in biomedical engineering.
This subject requires prior advanced knowledge on statistical signal processing, design of digital filters, and signal acquisition and conditioning.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

Capacidad para analizar, interpretar y procesar digitalmente señales biomédicas

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

## CONTENIDOS TEÓRICO-PRÁCTICOS

SYLLABUS:

TOPIC 1 - Introduction to biomedical signals
TOPIC 2 - Biomedical signal aquisition and conditioning
TOPIC 3 - Characterization of unidimensional biomedical signals
TOPIC 4 - Applications of biomedical signal processing of unidimensional signals
TOPIC 5 - Analysis and processing off biomedical images

LAB SESSION:
SESSION 1 - Aquisition of biomedical signals
SESSION 2 - Basic ECG processing
SESSION 3 - Respiratory component: tachogram and pressure signal
SESSION 4 - Detection of shockable rhythms: session I
SESSION 5 - Detection of shockable rhythms: session II
SESSION 6 - The electromiogram
SESSION 7 - The encephalogram
SESSION 8 - Segmentation of medical images
SESSION 9 - 3-D reconstruction of medical images

Details of the syllabus, laboratory sessions, and the description of the subject methodology are available in the eGela learning platform.

## METODOLOGIA (ACTIVIDADES FORMATIVAS)

| Actividad Formativa | Hours | Porcentaje presencialidad |
|---|---|---|
| Expository presentation of the contents and discussion | 0 | 0 % |
| Presentations and Papers | 2 | 100 % |
| Individual work and/or group work | 9,25 | 0 % |
| Computer work practice, laboratory, site visits, field trips, external visits | 22,5 | 50 % |
| Lectures | 22,5 | 50 % |
| Laboratory practicals | 56,25 | 40 % |

## TYPES OF TEACHING

| Types of teaching | M | S | GA | GL | GO | GCL | TA | TI | GCA |
|---|---|---|---|---|---|---|---|---|---|
| Hours of face-to-face teaching | 22,5 | | | 22,5 | | | | | |
| Horas de Actividad No Presencial del Alumno/a | 33,75 | | | 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 tools and percentages of final mark

| Denominación | Ponderación mínima | Ponderación máxima |
|---|---|---|
| Practical Examination | 30 % | 30 % |
| Written examination (theory) | 30 % | 30 % |
| Internship Report/Summary | 25 % | 25 % |
| Team work (problem solving, project design). | 15 % | 15 % |

## ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

ORDINARY CALL

The Evaluation systems comprises three independent parts: theory sessions (MAG), laboratory sessions (LAB), and a group work (TI). The MAG part is graded individually and the other two will be assigned a group grade.

The MAG part will be evaluated through an individual written exam based on short questions (30%).
The LAB part will be evaluated with a group grade, considering the reviewed LAB session reports (25%), and an individual exam consisting of two software programs closely related to those developed for the LAB session reports (30%).

The TI part will be evaluated with a group grade, and the works will be publicly presented in a collective session (15%).

The MAG part and the LAB part require a minimum grade of 5/10, and the overall grade must be above 5/10, once all the parts are aggregated. MAG, LAB and TI are independent and once the minimum grade (5/10) is achieved in one part, this grade will be kept for the following calls.

RESIGNATION:

The students unable to follow the combined evaluation must justify their reasons with proper documentation sent to the subject lecturers, according to the procedure established by the current regulation. They will be able to prove the achievement of the learning results by means of a final evaluation consisting of: (1) a written exam (30%), a laboratory exam (55%) and (3) the work (15%).

If the student does not attend the final written exam and the laboratory exam (both), the resignation will be assumed automatically.

## EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

EXTRAORDINARY CALL

The extraordinary call will consist of two exams, corresponding to the MAG and to the LAB parts, respectively. Each exam comprises 50% of the final grade. Both exams require a minimum grade of 5/10.
The students failing to provide an appropriate written documentation to justify their combined evaluation resignation, must prove the adequate development of a work related to biomedical signal processing.

## MANDATORY MATERIALS

MATERIALS

Materials for the MAG and the LAB sessions, as well as for the development of the work are available in the eGela platform.

## BIBLIOGRAFÍA

### Basic bibliography

BASIC BIBLIOGRAPHY:

JG Proakis and DG Manolakis. Digital signal processing. Principles, algorithms and applications. Pearson Prentice Hall. 2007.
L Sörnmo and P Laguna. Bioelectrical signal processing in cardiac and neurological applications. Elsevier, Academic Press. 2005.
W Birkfellner. Applied Medical Image Processing: A Basic Course. CRC Press 2014.

### Detailed bibliography

ADVANCED BIBLIOGRAPHY:

K.K. Najarian. Biomedical signal and image processing, CRC Press, 2006.
J.D. Bronzino. The biomedical engineering handbook, Vol1 y Vol2, CRC Press, 2000.
TM Deserno. Biomedical Image Processing. Springer-Verlag Berlin Heidelberg. 2011.

### Journals

JOURNALS:

IEEE Transactions on Biomedical engineering.
Physiological Measurement.

### Web sites of interest

INTERNET LINKS:

http://www.physionet.org/, PhysioBank: a big repository with annotated databases of biomedical signals, including tutorials on signal processing and other software tools for visualization and processing.

NBIA (National Biomedical Image Archive): Biomedical images repository
URL: https://imaging.nci.nih.gov/ncia/login.jsf