# MASTER COURSES FACULTY OF ENGINEERING – BILBAO

## MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (INTEL902)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credits</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>504010</td>
<td>Convergencia e Integración de Redes de Acceso y Troncales</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
<td>M</td>
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<tr>
<td>504005</td>
<td>Sistemas electrónicos de comunicaciones</td>
<td>Annual</td>
<td>9</td>
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<tr>
<td>504006</td>
<td>Diseño y gestión de redes y servicios de telecomunicación</td>
<td>Annual</td>
<td>9</td>
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<tr>
<td>504007</td>
<td>Micro electrónica</td>
<td>Sep. 2018-Jan. 2019</td>
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<tr>
<td>504008</td>
<td>Laboratorio de dispositivos micro electrónicos</td>
<td>Sep. 2018-Jan. 2019</td>
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<tr>
<td>504009</td>
<td>Electrónica de potencia</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
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<tr>
<td>504014</td>
<td>Laboratorio de circuitos digitales</td>
<td>Jan. 2019-May 2019</td>
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<tr>
<td>504015</td>
<td>Internet: Conceptos avanzados y nuevos servicios</td>
<td>Jan. 2019-May 2019</td>
<td>4,5</td>
<td>M</td>
</tr>
<tr>
<td>504018</td>
<td>Diseño avanzado de comunicaciones vía radio</td>
<td>Jan. 2019-May 2019</td>
<td>7,5</td>
<td>M</td>
</tr>
<tr>
<td>504023</td>
<td>Seguridad y Sistemas Distribuidos</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
<td>A</td>
</tr>
<tr>
<td>504026</td>
<td>Tecnologías del Habla</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
<td>A</td>
</tr>
<tr>
<td>504027</td>
<td>Procesado de señales biomédicas</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
<td>A</td>
</tr>
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## MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (ININD902)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Semester</th>
<th>Credits</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>503302</td>
<td>Diseño y Desarrollo de Producto</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
<td>A</td>
</tr>
<tr>
<td>503915</td>
<td>Dirección de Proyectos</td>
<td>Sep. 2018-Jan. 2019</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>503922</td>
<td>Diseño y Modelado Paramétrico</td>
<td>Jan. 2019-May 2019</td>
<td>4,5</td>
<td>M</td>
</tr>
<tr>
<td>503923</td>
<td>Ciclo de Vida del Producto</td>
<td>Jan. 2019-May 2019</td>
<td>4,5</td>
<td>M</td>
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<tr>
<td>503924</td>
<td>Laboratorio de Diseño de Producto</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
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</tr>
<tr>
<td>503953</td>
<td>Sistemas Informáticos Industriales</td>
<td>Jan. 2019-May 2019</td>
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<td>M</td>
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<tr>
<td>503955</td>
<td>Integración de Sistemas Industriales</td>
<td>Sep. 2018-Jan. 2019</td>
<td>4,5</td>
<td>A</td>
</tr>
</tbody>
</table>

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

By clicking the subject’s name, its Syllabus will appear.
## MDe MASTER AND DOCTORAL SCHOOL (908):

### DIREM401: Master in Business Management from an Innovation and Internationalization Perspective

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
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</thead>
<tbody>
<tr>
<td>502120</td>
<td>Gobierno y control de la empresa familiar/The governance and management of family firms</td>
<td>Jan. 2019 - May 2019</td>
<td>3</td>
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</tr>
<tr>
<td>502110</td>
<td>Comportamiento del consumidor y dirección de marca</td>
<td>Jan. 2019 - May 2019</td>
<td>3</td>
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</table>

### CUATE401: Master in Environmental Change and Human Impact in the Quaternary Period

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
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</thead>
</table>

### ECONO802: Inter-university Master's Degree Economics: Tools of Economic Analysis

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
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</thead>
<tbody>
<tr>
<td>503486</td>
<td>Técnicas de inferencia estadística</td>
<td>Sep. 2018 - Jan. 2019</td>
<td>3</td>
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</tbody>
</table>

### INQUI901: Interuniversity Master's Degree in Chemical Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SEMESTER</th>
<th>CREDITS</th>
<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>504265</td>
<td>Tecnologías de Refinería y Petroquímica</td>
<td>Jan. 2019 - May 2019</td>
<td>3</td>
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<tr>
<td>504267</td>
<td>Tecnologías catalíticas para el control de la contaminación del aire</td>
<td>Jan. 2019 - May 2019</td>
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<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Semester</td>
<td>Credits</td>
<td>Schedule</td>
</tr>
<tr>
<td>-------------</td>
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<tr>
<td>504309</td>
<td>Química Orgánica Avanzada</td>
<td>Sep. 2018- Jan. 2019</td>
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<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
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<th>Schedule</th>
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<tr>
<td>504088</td>
<td>Aplicaciones industriales de los polímeros</td>
<td>Sep. 2018- Jan. 2019</td>
<td>3</td>
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<tr>
<td>504104</td>
<td>Quimiometría aplicada</td>
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<td>3</td>
<td></td>
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<tr>
<td>504107</td>
<td>Técnicas Avanzadas de Procesado de Polímeros y Optimización mediante Simulación asistida por ordenador</td>
<td>Sep. 2018- Jan. 2019</td>
<td>4,5</td>
<td></td>
</tr>
</tbody>
</table>
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.

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

- Utilizar los conocimientos adquiridos para seleccionar, diseñar e implementar sistemas electrónicos de instrumentación y comunicaciones.
- Utilizar los conocimientos adquiridos para seleccionar dispositivos y sistemas electrónicos de comunicaciones e instrumentación adecuados, diseñarlos y validarlos como paso previo a su implementación.
- Capacidad para la puesta en marcha, dirección y gestión de procesos de fabricación de equipos electrónicos y de telecomunicaciones, con garantía de la seguridad para las personas y bienes, la calidad final de los productos y su homologación.

THEORETICAL/PRACTICAL CONTENT

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 acquire in theory through practical circuits that the student must design and assemble.

METODOLOGIA (ACTIVIDADES FORMATIVAS)

<table>
<thead>
<tr>
<th>Actividad Formativa</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom practicals</td>
<td>15</td>
<td>40 %</td>
</tr>
<tr>
<td>Laboratory practicals</td>
<td>75</td>
<td>40 %</td>
</tr>
<tr>
<td>Lectures</td>
<td>135</td>
<td>40 %</td>
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</table>
## TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
<th>TI</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom hours</td>
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<td>6</td>
<td>30</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Hours of study outside the classroom</td>
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<td>9</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

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

## TOOLS USED & GRADING PERCENTAGES

<table>
<thead>
<tr>
<th>Denominación</th>
<th>Ponderación mínima</th>
<th>Ponderación máxima</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written examination</td>
<td>60 %</td>
<td>60 %</td>
</tr>
<tr>
<td>Practical tasks</td>
<td>40 %</td>
<td>40 %</td>
</tr>
</tbody>
</table>

## ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

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 EXAM CALL: GUIDELINES & DECLINING TO SIT

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.

## COMPULSORY MATERIALS

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

## BIBLIOGRAPHY

### Basic bibliography

### In-depth bibliography
- Modern Electronic Communication (9th Edition) by Jeff Beasley and Gary M. Miller (May 6, 2007)

### Journals
- Microwaves & RF [news@news.mwrf.com]
- Microwaves Journal
- Microwave Engineering Europe [microwave@electronics-eetimes.com]
- analog@electronics-eetimes.com

### Useful websites
http://web.awrcorp.com/Usa/Products/Microwave-Office/
http://www.ni.com/labview/
Microwaves & RF [news@news.mwrf.com]
Microwaves Journal
Microwave Engineering Europe [microwave@electronics-eetimes.com]
analog@electronics-eetimes.com
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

Principles of power electronics circuits for efficient electric power conversion: semiconductors, topologies and most relevant applications, and fundamentals of calculus and design.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCIAS DE LA ASIGNATURA

Capacidad para proyectar, calcular y diseñar circuitos electrónicos para la conversión eficiente de energía eléctrica.

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

Calcular, diseñar y simular circuitos electrónicos para la conversión de energía eléctrica.

THEORETICAL/PRACTICAL CONTENT

1. POWER ELECTRONICS: REVISION ON BASIC PRINCIPLES
   1.1 POWER ELECTRONICS IN NEAR INDUSTRIAL SECTOR
   1.2 BASICS OF POWER CIRCUIT RESOLUTION
      1.2.1 RECTIFIERS
      1.2.2 DC/DC CONVERTERS
      1.2.3. INVERTERS
      1.2.4. CICLOCONVERTERS
2. POWER SEMICONDUCTORS
3. POWER CONVERTER CIRCUITS: PRACTICAL DESIGN ASPECTS
   3.1. SEMICONDUCTOR ASSOCIATION
   3.2 CURRENT OVERLAP.
   3.3. SEMICONDUCTOR PROTECTION: SNUBBER AND CLAMP CIRCUITS
   3.4. STATIC AND DYNAMIC THERMAL CALCULATION
   3.5. SEMICONDUCTOR HOUSING
   3.6 MODELLING OF POWER CONVERTERS
   3.7. DESIGN CONCEPTS FOR DC/DC CONVERTERS, INVERTERS,MAGNETICS AND DRIVERS

4. APPLICATIONS.
   4.1 CONSUMER ELECTRONICS
   4.2 INDUSTRY, TRACTION AND PROPULSION
   4.3 ENERGY CONVERSION

METODOLOGIA (ACTIVIDADES FORMATIVAS)

<table>
<thead>
<tr>
<th>Actividad Formativa</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory practicals</td>
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</tr>
<tr>
<td>Computer practicals</td>
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<tr>
<td>Lectures</td>
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TYPES OF TEACHING

<table>
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<tr>
<th>Type of teaching</th>
<th>M</th>
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<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
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<td>15</td>
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<td>27,5</td>
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TOOLS USED & GRADING PERCENTAGES

<table>
<thead>
<tr>
<th>Denominación</th>
<th>Ponderación mínima</th>
<th>Ponderación máxima</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written examination</td>
<td>40 %</td>
<td>40 %</td>
</tr>
<tr>
<td>Practical tasks</td>
<td>60 %</td>
<td>60 %</td>
</tr>
</tbody>
</table>
**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

In order to pass the course, it is mandatory to pass separately the written exam and the continuous assessment parts. Any student who wishes to renounce to the continuous assessment of the course will do so according to the current regulation.

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

Those students who did not pass any of the parts of the course (written exam or continuous assessment) will be assessed in the extraordinary call through a written exam of the whole of the course.

**COMPULSORY MATERIALS**

**BIBLIOGRAPHY**

**Basic bibliography**

"Electrónica de Potencia" Daniel W. Hart. Ed. Prentice Hall

**In-depth bibliography**

"Electrónica de Potencia: Componentes, topologías y equipos" Salvador Martinez García, Juan Andrés Guald Gil, Ed. Thomson
"Electrónica de Potencia" M. Rashid Ed. Prentice Hall
"Fundamentals of Power Electronics" R.W. Erickson, Kluwer..

**Journals**

IEEE Transactions on Power Electronics.
Bodo's Power Systems.

**Useful websites**

http://cusp.umn.edu/
http://www.semikron.com
http://www.pwrx.com/LibrarySearch.aspx
http://www.pels.org/
SUBJECT
504014 - Digital Circuit Laboratory  

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
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

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

THEORETICAL/PRACTICAL CONTENT

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.
TOOLS USED & GRADING PERCENTAGES

<table>
<thead>
<tr>
<th>Lectures</th>
<th>30</th>
<th>50 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory practicals</td>
<td>82.5</td>
<td>36 %</td>
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</table>

**TYPES OF TEACHING**

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>M</th>
<th>S</th>
<th>GA</th>
<th>GL</th>
<th>GO</th>
<th>GCL</th>
<th>TA</th>
<th>TI</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom hours</td>
<td>15</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>Hours of study outside the classroom</td>
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<td>52.5</td>
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</table>

Legend:
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**TOOLS USED & GRADING PERCENTAGES**

<table>
<thead>
<tr>
<th>Denominación</th>
<th>Ponderación mínima</th>
<th>Ponderación máxima</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written examination</td>
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<td>50 %</td>
</tr>
<tr>
<td>Practical tasks</td>
<td>50 %</td>
<td>75 %</td>
</tr>
</tbody>
</table>

**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

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 EXAM CALL: GUIDELINES & DECLINING TO SIT**

Examen práctico por el 100% de la asignatura

**COMPULSORY MATERIALS**

- Xilinx University Program: http://www.xilinx.com/support/university/students.html

**BIBLIOGRAPHY**

**Basic bibliography**


**In-depth bibliography**


**Journals**

**Useful websites**

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/


**TEACHING GUIDE**

2018/19

<table>
<thead>
<tr>
<th>Centre</th>
<th>345 - Faculty of Engineering - Bilbao</th>
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<tr>
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<td>Cycle</td>
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**SUBJECT**

504018 - Advanced Radio Communications Design

**ECTS Credits:** 7,5

**DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT**

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 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.
- Capacidad para desarrollar sistemas de radiocomunicaciones: diseño de antenas, equipos y subsistemas, modelado de canales, cálculo de enlaces y planificación.

**RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA**

- Diseñar, dimensionar y planificar sistemas de radiocomunicaciones (troncales y de acceso), subsistemas de la red de comunicaciones móviles, sistemas de comunicaciones basados en satélite, sistemas radar y sistemas de radionavegación. En dichas tareas el alumno deberá ser capaz de calcular balances de potencia y coberturas radioeléctricas y de trabajar con modelos de canal, así como aplicar estos resultados como requisitos de diseño de los sistemas mencionados.
- Diseño de sistemas en escenarios reales de comunicaciones inalámbricas multimedia, terrestres y vía satélite, con decisiones orientadas a la optimización en la calidad de la propagación en los enlaces en nuevas bandas de frecuencias, la gestión del espectro radioeléctrico, la integración de sistemas y la implementación de soluciones.

**THEORETICAL/PRACTICAL CONTENT**

Lectures and seminars.

- **Topic 1.** Advanced propagation theory. Review of free space propagation and radiant systems. Channel models and propagation models. Problems.


- **Topic 5.** Radar and radionavigation systems. Review of fundamentals and design of radar systems. Geolocation services. Problems.

Laboratory projects.

- **Project 1.** 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 2.** Introduction to simulation SW. Antenna design Case study: design and simulation of microstrip antennas. Result presentation.

- **Project 3.** 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 4.** LTE network simulation. Tutorial and general coverage objectives for the development of the network. Result presentation.
**METODOLOGÍA (ACTIVIDADES FORMATIVAS)**

<table>
<thead>
<tr>
<th>Actividad Formativa</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
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<td>Laboratory practicals</td>
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**TYPES OF TEACHING**

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**TOOLS USED & GRADING PERCENTAGES**

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<tr>
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<td>Presentations</td>
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<td>Multiple-choice examination</td>
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**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

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.

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 6% of the final grade of the course, so that, being 5 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 not have to develop a presentation-format report from the scratch for that project. They will be allowed to take 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. Finally, in project number 5, all the groups will write a brief report, in presentation format, that will be the only element considered for the numerical grading of this project.

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-going 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 EXAM CALL: GUIDELINES & DECLINING TO SIT**

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.

**COMPULSORY 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.

**BIBLIOGRAPHY**

**Basic bibliography**


**In-depth bibliography**

Bahl I. "Microwave Solid State Circuit Design"- John Wiley & Sons
Radar System Analysis and Modeling, D. K. Barton, Artech House , 2005

**Journals**

IEEE Transactions on Communications
IEEE Transactions on Vehicular Technology
IEEE Transactions on Broadcasting
IEEE Antennas and Wireless Propagation Letters

**Useful websites**

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://ieeexplore.ieee.org
http://www.esa.int/esaNA/galileo.html
http://www.gps.gov
# TEACHING GUIDE 2018/19

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<td>Second year</td>
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## SUBJECT

504026 - Speech Technologies

| ECTS Credits: | 4,5 |

## DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

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 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.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

### COMPETENCIAS DE LA ASIGNATURA

- 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.
- Conocer e interpretar los procesos de generación y percepción de la voz humana.
- 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.
- Comprender e interpretar los principales parámetros utilizados en la representación de la señal de voz.

### RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

- Describir los procesos de generación y percepción de la señal de voz.
- Demostrar conocimientos sobre la representación temporal y frecuencial de la señal de voz y sobre las técnicas empleadas para su análisis.
- Demostrar comprensión de los problemas relacionados con el modelado acústico de la señal de voz, el modelado del lenguaje, los sistemas de reconocimiento automático del habla, del hablante y de síntesis de voz, así como las técnicas utilizadas para la evaluación de los mismos.
- Medir e interpretar los principales parámetros que caracterizan la señal de voz.
- Implementar un codificador perceptual de voz.
- Desarrollar un sistema básico de reconocimiento del habla.

## THEORETICAL/PRACTICAL CONTENT

- **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)

<table>
<thead>
<tr>
<th>Actividad Formativa</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
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<td>40 %</td>
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<tr>
<td>Lectures</td>
<td>56,25</td>
<td>40 %</td>
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## TYPES OF TEACHING

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

## TOOLS USED & GRADING PERCENTAGES
The evaluation is divided in three independent parts: master lessons, lab practices and research work. The knowledge about the master lessons will be proven with a multiple choice 20 question test. The lab practices will be evaluated by the reports and the work developed at the lab. The research work will be evaluated by means of the prepared paper and the presentation made in the last session of the course.

In the regular evaluation, the exam must be passed with almost a 4/10 and to succeed in the subject the final grade a 5/10 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.

By not showing to the final written exam, the student refuses to take part in the call.

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<td>30 %</td>
<td>75 %</td>
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**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

The students that have not presented the written justification to elude in the continuous evaluation must prove they have correctly completed the lab practices.

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

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 5/10.

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

**BIBLIOGRAPHY**

**Basic bibliography**

**In-depth bibliography**
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

Useful websites

- Speech Technologies
  http://www.speech.cs.cmu.edu/
  news:comp.speech
  http://festvox.org/
- Review of Speech Synthesis Technology:
- Speech Technology Hyperlinks Page
  http://www.speech.cs.cmu.edu/comp.speech/Section5/speechlinks.html
- Smithsonian Speech Synthesis History Project (SSSHP)
  http://americanhistory.si.edu/archives/speechsynthesis/ss_home.htm
- TTS demos
  http://aholab.ehu.es/tts/tts_en.html
### TEACHING GUIDE 2018/19

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

**Cycle** Indiferente

**Plan** INTEL902 - Master in Telecommunication Engineering

**Year** Second year

**SUBJECT**

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<tbody>
<tr>
<td>504027</td>
<td>Biomedical Signal Processing</td>
<td>4.5</td>
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**DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT**

**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**

**THEORETICAL/PRACTICAL CONTENT**

**SYLLABUS:**

- **TOPIC 1:** Introduction to biomedical signals
- **TOPIC 2:** Biomedical signal acquisition and conditioning
- **TOPIC 3:** Characterization of unidimensional biomedical signals
- **TOPIC 4:** Applications of biomedical signal processing of unidimensional signals
- **TOPIC 5:** Analysis and processing of biomedical images

**LAB SESSION:**

- **SESSION 1:** Acquisition 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)**

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**TOOLS USED & GRADING PERCENTAGES**

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<td>90 %</td>
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**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

**ORDINARY CALL**

El sistema de evaluación consta de tres partes independientes: sesiones teóricas (MAG), sesiones de laboratorio (LAB), y una investigación experimental (TI). El MAG se califica individualmente y el resto se asigna una calificación grupal.

El MAG será evaluado a través de un examen escrito individual basado en preguntas cortas (30%).

El LAB será evaluado con una calificación grupal, considerando los informes revisados de sesiones de LAB (25%), y un examen individual consistiendo en dos programas de software desarrollados para las sesiones de LAB (30%).

El TI será evaluado con una calificación grupal, considerando el informe entregado (10%) y la presentación oral (5%).

El MAG y el LAB requieren un mínimo de 5/10, y la calificación total debe ser superior a 5/10, una vez que todas las partes se agrupan. MAG, LAB y TI son independientes y una vez que se alcanza el mínimo de 5/10 en una parte, esta calificación se conservará para las siguientes convocatorias.

**RESIGNATION:**

Los estudiantes incapaces de seguir el plan de evaluación conjunto deben justificar sus razones con documentación adecuada enviada a los profesores de la materia, según el procedimiento establecido en la última regulación. Podrán demostrar el buen desarrollo de los resultados de aprendizaje mediante una evaluación final consistente en: (1) un examen escrito (30%), un examen de laboratorio (55%) y (3) la presentación de un informe de investigación (15%).

Si el estudiante no asiste al examen escrito final y al examen de laboratorio (ambos), la resignación será asumida automáticamente.

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

**EXTRAORDINARY CALL**

La convocatoria extraordinaria consiste en dos exámenes, correspondiente al MAG y al LAB respectivamente. Cada examen comprende 50% de la calificación final. Ambos exámenes requieren un mínimo de 5/10.

Los estudiantes que no puedan crear una documentación escrita adecuada para justificar su resignación, deben demostrar el adecuado desarrollo de un proyecto relacionado con la procesamiento de señales biomedicas.

**COMPULSORY MATERIALS**

**MATERIALS**

 materiales para las sesiones MAG y LAB, así como para el desarrollo del trabajo de investigación, están disponibles en el portal eGela.
BIBLIOGRAPHY

Basic bibliography

BASIC BIBLIOGRAPHY:


In-depth bibliography

ADVANCED BIBLIOGRAPHY:


Journals

JOURNALS:

IEEE Transactions on Biomedical engineering.
Physiological Measurement.

Useful websites

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
TEACHING GUIDE 2018/19

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SUBJECT

503955 - Integration of Industrial Systems

ECTS Credits: 4,5

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

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.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCIAS DE LA ASIGNATURA

Capacidad para diseñar y proyectar sistemas de producción automatizados y control avanzado de procesos.

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

- Utilizar los conocimientos adquiridos para seleccionar, diseñar e implantar sistemas de integración dentro de entornos de producción automatizados.
- Utilizar los conocimientos adquiridos para seleccionar las estrategias de integración de sistemas de control de procesos adecuadas, diseñarlas y validarlas como paso previo a su implementación.

THEORETICAL/PRACTICAL CONTENT

THEORETICAL SUBJECTS:


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

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
- 7th Seminar: PROFINet-I/O
- 8th Seminar: OPC-DA
- 9th Seminar: OPC-UA
- 10th 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-I/O 1/2 (2 hours)
- 7th Practice: OPC-DA communications (2 hours)
- 8th Practice: Supervisory systems (2 hours)

METODOLOGIA (ACTIVIDADES FORMATIVAS)

<table>
<thead>
<tr>
<th>Actividad Formativa</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>37,5</td>
<td>40 %</td>
</tr>
<tr>
<td>Seminars</td>
<td>37,5</td>
<td>40 %</td>
</tr>
<tr>
<td>Laboratory practicals</td>
<td>37,5</td>
<td>40 %</td>
</tr>
</tbody>
</table>
**TOOLS USED & GRADING PERCENTAGES**

<table>
<thead>
<tr>
<th>Denominación</th>
<th>Ponderación mínima</th>
<th>Ponderación máxima</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written examination</td>
<td>40 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Practical tasks</td>
<td>0 %</td>
<td>10 %</td>
</tr>
<tr>
<td>Practical tasks</td>
<td>30 %</td>
<td>60 %</td>
</tr>
</tbody>
</table>

**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

- 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 EXAM CALL: GUIDELINES & DECLINING TO SIT**

- 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.

**COMPULSORY 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
BIBLIOGRAPHY

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

In-depth 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. Diez Aznar
Publisher: Editorial de la Universidad Politécnica de Valencia
Year of Publication: 2011

Journals
Automática e Instrumentación http://www.tecnipublicaciones.com/automatica/

Useful websites
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
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

Robotics is a multidisciplinary subject, that deals with the elements composed by a robotic system, its design and programming. Hence, this subject covers all these areas, from the modelling, control and programming of a robot, to the integration of a robot in an automated system, providing tools to evaluate the convenience of installing a robot and the most suitable way to do it.

The subject is composed by 6 ECTS credits (60 lecture hours and 90 personal working hours). From these credits, 3 ECTS (30 hours) correspond to theory, 1.5 ECTS to seminars and 1.5 ECTS to laboratory sessions.

This subject is given in the 2nd course of the Industrial Engineering Master.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCIAS DE LA ASIGNATURA

- Han la capacidad para diseñar y proyectar sistemas de producción automatizados y control avanzado de procesos.

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

- Utilizar los conocimientos adquiridos para formular el modelo cinemático y dinámico de un robot industrial, diseñar el sistema de control de alto nivel (generador de trayectorias) y bajo nivel (estrategias de control para que cumplan las especificaciones establecidas), así como saber programar a nivel robot cualquier tarea encomendada.

- Utilizar los conocimientos adquiridos para diseñar células robotizadas en las que resulta adecuado la incorporación de robots industriales, siendo capaces los egresados en su ejercicio profesional de abordar la robotización de un proceso productivo.

THEORETICAL/PRACTICAL CONTENT

The contents of the subject are divided in three main content blocks:

I-Automation Systems
1.-Automation Devices
1.1. Introduction
1.2. Robot Subsystems

2.-Instrumentation and actuators
2.1. Introduction
2.2. Pneumatic and Hydraulic actuators
2.3. Electric actuators
2.4. PLC Open Motion Control
2.5. Actuation Sync

3.-Robotic Systems
3.1. Introduction
3.2. State of the Art provided by a Robot Manufacturer
3.3. Market data
3.4. Industrial application examples

II-Robot Modelling and Control

4.- Kinematics
4.1.-Introduction
4.2.-Spatial location tools
4.3.-Position problem
4.4.- Velocity Problem

5.-Dynamics
5.1.- Introduction
5.2.- Dynamic Modelling approaches
5.3.- Direct and Inverse Dynamics

III-Robot Programming
6-Industrial Robot Programming
6.1.-Introduction
6.2.-Programming methods
6.3.-Programming system requirements
6.4.-Programming languages
6.5.- Programming examples

7.- Trajectory generation
7.1.- Introduction
7.2.-Trajectory generation algorithms
7.3.-Interpolators
7.4.- Examples

8.-Control Strategies
8.1.-Introduction
8.2.-Monoarticular Control
8.3.-Multiarticular Control
8.4.-Position/Hybrid/Force control
8.5.-Examples

Practical/Laboratory sessions:

Actuators
PA1- Speed control in open and closed loop
PA2- Position Control
PA3- 2 axes sync

Simulation
PL1-Position problem
PL2-Velocity problem and dynamic model
PL3-Kinematic and Dynamic Control

Programming
PL4- Industrial Robot Programming I
PL5- Industrial Robot Programming II

**METODOLOGIA (ACTIVIDADES FORMATIVAS)**

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<thead>
<tr>
<th>Actividad Formativa</th>
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<tbody>
<tr>
<td>Laboratory practicals</td>
<td>37.5</td>
<td>40 %</td>
</tr>
<tr>
<td>Seminars</td>
<td>37.5</td>
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<tr>
<td>Lectures</td>
<td>75</td>
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**TYPES OF TEACHING**

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

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

**TOOLS USED & GRADING PERCENTAGES**

<table>
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<th>Denominación</th>
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<tr>
<td>Practical tasks</td>
<td>30 %</td>
<td>60 %</td>
</tr>
<tr>
<td></td>
<td>0 %</td>
<td>10 %</td>
</tr>
</tbody>
</table>

**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

The following evaluation tools are used to evaluate this subject:
1.-Midterm exam. Written and practical exam that will be carried out mid term and will evaluate the instrumentation and actuation concepts of the subject. 15%
2.-Laboratory work. Practical session preparation works and calculations will be evaluated using eGela. 20%
3.-Final exam. Written exam that will be carried out in the official dates defined by the Faculty, with short question and
In order to pass the subject it will be required to obtain at least the 50% the value of the Final Exam. If this is achieved, then the points obtained in the midterm exam and the laboratory work will be added.

RESIGNATION TO THE CALL
A no-show in the final exam will be considered a resignation to the call.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

The same tools defined for the ordinary call will be defined:
1. Midterm exam. Written and practical exam that will be carried out mid term and will evaluate the instrumentation and actuation concepts of the subject. 15%
2. Laboratory work. Practical session preparation works and calculations will be evaluated using eGela. 20%.
3. Final exam. Written exam that will be carried out in the official dates defined by the Faculty, with short question and problems. 65%

The evaluation tools 1 and 2 will be maintained from the ordinary call, being part of the continuous evaluation of the subject.

In order to pass the subject it will be required to obtain at least the 50% the value of the Final Exam. If this is achieved, then the points obtained in the midterm exam and the laboratory work will be added.

RESIGNATION TO THE CALL
A no-show in the final exam will be considered a resignation to the call.

COMPULSORY MATERIALS

Documentación de apoyo a la teoría, seminarios y laboratorio se encuentra en el aula virtual de la asignatura

BIBLIOGRAPHY

Basic bibliography
- INTRODUCTION TO ROBOTICS: MECHANICS AND CONTROL. Ed. Addison Wesley. 2005
- INSTRUMENTACIÓN INDUSTRIAL. A. Creus. Ed. Marcombo, 2005

In-depth bibliography

Journals
- ADVANCED ROBOTICS
- IEEE ROBOTICS & AUTOMATION MAGAZINE
- INTERNATIONAL JOURNAL OF ROBOTICS & AUTOMATION
- ROBOTICS AND COMPUTER-INTEGRATED MANUFACTURING
- INTERNATIONAL JOURNAL OF COMPUTER VISION
- JOURNAL OF VISION
- VISION RESEARCH

Useful websites
- Grupo de Visión por Computador CEA-IFAC http://ceavision.unileon.es/
- UKIVA - Información Visión http://www.ukiva.org/
- OpenCV - Software libre Visión
  o http://sourceforge.net/projects/opencv/
  o http://opencv.willowgarage.com/wiki/Welcome
GLOBALISATION AND FINANCIAL MANAGEMENT
SYLLABUS ENGLISH

Leire San-Jose
Office building 1st floor, No. 50
Ph.: +34-946013808 leire.sanjose@ehu.eus

Other teacher in Spanish language: Txomin Iturralde and Sara Urioanbarrenetxea

COMPETENCIES
The course Globalisation and Financial Management is a core subject taught in the first semester of the first year of the Master of Business Management from an Innovation and Internationalization Perspective.
Globalisation and Financial Management addresses students in the following skills and competencies (12% weight each):

- Enhance research capacity in finance: develop the skills to identify, analyze, study and solve scientific problems in financial area
- Understand the new corporate financial environment: from benefits to values
- Evaluate the possible effects in financial area from emerging phenomena
- Develop the ability to adapt to the new business environment
- Understand the essentials of cash management
- Analyze and Identify the effects of a change in the dividend policy on the value of the company
- Establish the methodology of empirical research that fits the purpose of a financial research
- Assess the ethical problems in finance

TEACHING FORMAT

<table>
<thead>
<tr>
<th>TYPE</th>
<th>FACE-TO-FACE HOURS</th>
<th>NON FACE-TO-FACE HOURS</th>
<th>TOTAL HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>15</td>
<td>22.5</td>
<td>37.5</td>
</tr>
<tr>
<td>Seminars</td>
<td>15</td>
<td>22.5</td>
<td>37.5</td>
</tr>
</tbody>
</table>

A mixture of teaching methodologies is scheduled:
LECTURE CLASS. This is a teaching method in which there are no splits; it thus corresponds to large groups. It encompasses both theoretical and practical classes.

SEMINARS. This teaching method is applicable in small groups since it allows greater interaction between professors and students. The work will be supervised by the Professor.

TRAINING ACTIVITIES

<table>
<thead>
<tr>
<th>NAME</th>
<th>HOURS</th>
<th>PERCENTAGE OF CLASSROOM TEACHING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture class</td>
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</tr>
<tr>
<td>Group discussion</td>
<td>20.0</td>
<td>40%</td>
</tr>
<tr>
<td>Readings</td>
<td>10.0</td>
<td>0%</td>
</tr>
<tr>
<td>Student’s personal work</td>
<td>15.0</td>
<td>0%</td>
</tr>
</tbody>
</table>

OUT-OF-CLASSROOM WORK. In addition to class hours, materials will be provided for the students to complete their training; they can be assisted during tutorial hours.

ASSESSMENT SYSTEM

<table>
<thead>
<tr>
<th>NAME</th>
<th>MINIMUM WEIGHTING</th>
<th>MAXIMUM WEIGHTING</th>
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<tbody>
<tr>
<td>Attendance and participation</td>
<td>15.0%</td>
<td>35.0%</td>
</tr>
<tr>
<td>Evaluation by means of the presentation of projects</td>
<td>10.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Presentations</td>
<td>15.0%</td>
<td>35.0%</td>
</tr>
<tr>
<td>Questions to discuss</td>
<td>10.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td>Writing skills in group</td>
<td>15.0%</td>
<td>35.0%</td>
</tr>
</tbody>
</table>

SCHEDULE

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.

**BIBLIOGRAPHY**


DESCRIPTION AND CONTEXTUALIZATION OF THE COURSE

Family firms account for over 80% of commercial companies and are the principal creators of employment in the private sector. Worldwide, they are the main generators of GDP, playing a significant role in economic growth and territorial development. Common denominators of such firms include family involvement in the company 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 company 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 analysis and decision-making in family firms in a global environment. The course will examine specific features of family firms in areas such as generational succession, organs of governance, relationships between firm and family and internal behaviour and relations and analyse their influence on entrepreneurship, innovation capacity and internationalisation in the firm.

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, with particular emphasis on financial and legal aspects arising from the relationship between family and firm.

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

✓ Identifying the strengths and weaknesses of family businesses resulting from the fact that they are controlled by one or more families, 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.

✓ Developing management skills that promote growth and internationalisation of the family firm.
THEORETICAL-PRACTICAL CONTENTS

Theme 1. FAMILY BUSINESS: CULTURE AND VALUES

Theme 2. STRENGTHS AND WEAKNESSES OF THE FAMILY BUSINESS

Theme 3. LIFECYCLES OF THE FAMILY BUSINESS. IMPLICATIONS FOR THE GOVERNANCE AND MANAGEMENT OF BUSINESS AND FAMILY SYSTEMS

Theme 4. FINANCIAL ASPECTS OF THE FAMILY BUSINESS

Theme 5. THE CONCEPT OF VALUE IN THE FAMILY BUSINESS: INCORPORATING EMOTIONAL VARIABLES

Theme 6. ENTREPRENEURIAL ORIENTATION AND THE FAMILY BUSINESS

Theme 7. INTERNATIONALISATION OF THE FAMILY BUSINESS

The course contents will be complemented with a series of seminars and lectures 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).

FOLLOWING THE COURSE

In general, all sessions will include one part involving lectures and another devoted to discussing cases and readings. 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.

RECOMMENDED READING LIST

Books and recommended readings


Journals

Entrepreneurship Theory and Practice (ETP): http://journals.sagepub.com/home/etp


Family Business Review: http://journals.sagepub.com/home/fbr


Websites

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/
CONSUMER BEHAVIOR AND BRAND MANAGEMENT: RESEARCH METHODS

LEARNING GUIDE 2018/19
908 - School of Master and Doctorate
DIREM401 - Master's Degree in Business Management from Innovation to Internalization

SUBJECT: 502110 - Consumer Behavior and Brand Management: Research Methods

DESCRIPTION AND CONTEXTUALIZATION OF THE SUBJECT
This subject addresses the fundamentals and concepts of consumer behavior and brand management from a scientific and methodological approach. The student will have to understand the concepts related to these research areas, as well as being able to explain the theoretical framework, hypotheses formulation, methodology, data analysis, conclusions and limitations of a research study.

COMPETENCES / LEARNING OUTCOMES OF THE SUBJECT

COMPETENCES OF THE SUBJECT
Perform basic and applied research in the field of consumer behavior, with a rigorous scientific basis and a solid method.
Pursue continuous improvement in knowledge assuming an ethical commitment to work, society and the environment.
Manage databases available to students, to access useful information for the research activity.
Learn how to create a database for the development of research projects.
Prepare and present a report (written or oral) about the field of study, understandable both to a specialized and non-specialized audience, with clarity and coherence.
Learn in an autonomous and disciplined way to carry out research work, to provide the students with the capacity for autonomous learning in the future.
Analyze and synthesize information from diverse sources and with critical capacity, to make reasoned judgments on relevant economic, social and scientific issues.

LEARNING OUTCOMES OF THE SUBJECT

THEORETICAL-PRACTICAL CONTENTS

Consumer behavior: influential factors
Analysis of consumer behaviour models
Emotions and their influence on consumer behavior
Evolutionary psychology: evolutionary patterns of behavior
Brand management: determination of its attributes and benefits
The satisfaction and loyalty of the consumer towards brands

METHODOLOGY (TRAINING ACTIVITIES)

Group discussion
Management of sources and resources
Communication skills training
Readings
Team work
Course work (teamwork with the option of individual work)
Preparation of reports and presentations
Presentations
EVALUATION

Attendance and participation
Critical debate in the classroom
Group or individual course work
Presentation of the course work

Students will be evaluated through the presentation in class of a research article related to the subject areas. Students should be able to explain the theoretical framework, hypotheses formulation, methodology, data analysis, conclusions and limitations of a research paper.

LITERATURE

APAOLAZA IBÁÑEZ, VANESSA; HARTMANN, PATRICK; DIEHL, SANDRA; TERLUTTER, RALF (2008): Women's Satisfaction with Cosmetic Brands: The Influence of Instrumental and Advertising-Induced Experiential Brand Associations, 7th International Conference on Research in Advertising (ICORIA), Antwerp, 26-28 Junio, 2008


Reference Journals

Communication Research
Computers in Human Behavior
Environment and Behavior
European Journal of Marketing
Food Quality and Preference
International Journal of Advertising
International Journal of Consumer Studies
International Journal of Hospitality Management
International Journal of Service Industry Management
Journal of Academy of Marketing Science
Journal of Advertising
Journal of Business Ethics
Journal of Business Research
Journal of Consumer Behaviour
Journal of Consumer Psychology
Journal of Consumer Research
Journal of Environmental Psychology
Journal of International Marketing
Journal of Marketing
Journal of Sensory Studies
Journal of Service Research
Psychology & Marketing
INTRODUCTION TO THE QUATERNARY

TEACHING GUIDE 2018/19
Centre 908 - Master and Doctoral School
Plan CUATE401 - Master in Quaternary: Environmental Change and Human
Fingerprint
Cycle Indifferent
Year Indifferent
SUBJECT 502089 - Introduction to the Quaternary
ECTS Credits: 4

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
Introductory subject to the master's programme that includes aspects related to the
causes of Quaternary climate variability, together with the temporal
transformation of the different sedimentary environments, human evolution during
this time interval, as well as to the different techniques (micropalaeontological,
sedimentological and geochemical) involved in the study of these processes.
Consequently, it represents a necessary introduction to all the aspects that are
analyzed in detail through the rest of the subjects of this master's degree.
Therefore, this subject is the first one that the students study within the
compulsory module.

The objectives that this subject proposes are the following:
- Knowledge of the natural and anthropogenic processes that have operated on
  Earth during the last 2.6 million years;
- Identification and characterization of the different types of geomorphological,
sedimentary and palaeontological evidences that are used for their reconstruction;
- Description of the principles and fundamentals of the geochronological methods
  used in the Quaternary, its applicability, limitations and usage;
- Study of the biological and cultural keys of the evolution of the hominins, from the
  Pliocene to the appearance of Homo sapiens, including the general revision of their
  fossil record (taxonomy and phylogeny);
- Study of practical examples of multidisciplinary interpretation of the recent
  sedimentary record with special emphasis on the deposits of the Cantabrian,
  Iberian and European areas.

This subject is taught by lecturers belonging to two different institutions: UPV/EHU
and CENIEH.

Lectures are given at the UPV/EHU facilities in the Campus of Leioa (Faculty of
Science and Technology). The field trips are made in the places of destination
(Bilbao and Atapuerca) with students leaving from the university campus of Leioa.
The laboratory practices are carried out at the CENIEIH facilities in Burgos, with
students leaving from the Leioa university campus.

Participation of the CENIEIH personnel in the teaching activities as well as the use of
the CENIEIH facilities by the students during the practical activities, are governed by
a collaboration agreement between both institutions.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
COMPETENCIES OF THE SUBJECT
- Basic knowledge of computer science and acquisition of electronic information.

- Oral and written communication in the native language and development of a
  foreign language that allows working in an international context.

- Ability to organize and plan personal work. Motivation for a well-done job.

- Capacity for analysis, synthesis and management of information about the
  processes that have operated during the Quaternary.
-Learning and autonomous and creative work in relation to the multidisciplinary contents raised in the subject.

-Acquisition of basic general knowledge about the processes that have operated on our planet during the Quaternary and the development of research on Quaternary themes.

THEORETICAL/PRACTICAL CONTENTS
1. The Quaternary record. Duration and characteristics of the Quaternary period. Development of Quaternary studies.
6. Introduction to Quaternary dating methods.
7. Principles and fundamentals of the different methods based on radioactivity, trapped charges, exposure to radiation, and archaeo- and palaeomagnetism.

METHODS

TYPES OF TEACHING

<table>
<thead>
<tr>
<th>Type of teaching</th>
<th>Classroom hours</th>
<th>Hours of study outside the classroom</th>
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<td>24</td>
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TOOLS USED & GRADING PERCENTAGES

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Continuous assessment:
- Assistance to class (10%)
- Questions and debates to be developed in class (20%)
- Read and analysis of reference texts (20%)
- Practical application of theoretical materials (20%)

Final evaluation:
- Workbook (30%)

These evaluation criteria will be applicable for both the ordinary and the extraordinary calls.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Continuous assessment:
- Assistance to class (10%)
- Questions and debates to be developed in class (20%)
- Read and analysis of reference texts (20%)
- Practical application of theoretical materials (20%)

Final evaluation:
- Workbook (30%)

These evaluation criteria will be applicable for both the ordinary and the extraordinary calls.

COMPULSORY MATERIALS
- Master lectures: based on graphic material and reduced texts edited in PowerPoint, to be developed in a classroom with usual didactic and audiovisual resources that include laptop and cannon. Availability of complementary bibliography on the subject in electronic format.
- Field trips: based on graphic material previously prepared by the lecturer that serves as a guide for the explanation and discussion on the ground of the activities to be developed.
- Laboratory practices: based on reference collections and analytical equipment available at CENIEH.

In addition, the subject has a moodle/egela course for the possible electronic download by the students of all the documentation used in the different activities developed in this subject.

BIBLIOGRAPHY

Basic bibliography
In-depth bibliography

For each topic, students are recommended to consult certain specific articles recently published in specialized scientific journals that, in some cases, will be available in the moodle/egela course.

Journals

- Anthropocene (Elsevier, ISSN: 2213-3054): //www.journals.elsevier.com/anthropocene/
- Open Quaternary (online, open access): //www.openquaternary.com/
- Quaternaire (AFEQ, ISSN: 1965-0795): //quaternaire.revues.org/
- Quaternary Geochronology (Elsevier, ISSN: 1871-1014): //www.journals.elsevier.com/quaternary-geochronology/
- Quaternary International (Elsevier, ISSN: 1040-6182): //www.journals.elsevier.com/quaternary-international/
- Quaternary Research (Elsevier, ISSN: 0033-5894): //www.journals.elsevier.com/quaternary-research/
- Quaternary Science Reviews (Elsevier, ISSN: 0277-3791): //www.journals.elsevier.com/quaternary-science-reviews/
- The Anthropocene Review (Sage, ISSN: 2053-0196): //anr.sagepub.com/
- The Holocene (Sage, ISSN: 0959-6836): //hol.sagepub.com/

Useful websites

- Asociación Española para el Estudio del Cuaternario (AEQUA): //tierra.rediris.es/aequa/
- International Union for Quaternary Research (INQUA): //www.inqua.org
- Subcommission on Quaternary Stratigraphy (SQS): //www.quaternary.stratigraphy.org.uk/
- Intergovernmental Panel on Climate Change (IPCC), Working Group I-The Physical Science Basis: //www.ipccwg1.unibe.ch
The learning process of this subject is oriented towards the acquisition of fundamental knowledge of the geological processes involved in the creation, destruction and preservation of the Quaternary geological record. This involves the following aspects:

- To identify current sedimentary environments and working geological processes.

- To understand the evolution of the environments and their controlling factors (tectonics, climate, volcanism, etc.).

- To analyse Neogene and Quaternary successions from a stratigraphic and sedimentological point of views, with special attention to continental and coastal sedimentary environments.

- To reconstruct stratigraphic sequences with the aim of placing archaeological remains in context.

- To determine the dynamics of Quaternary sedimentary systems in order to obtain palaeogeographical, palaeoenvironmental and paleoecological interpretations.

- To use this knowledge for the recuperation and protection of Natural Spaces.

The content of the subject is closely related to the other modules of the masters course. A transversal methodology with all the other modules will be followed.

**LEARNING OUTCOMES AND COMPETENCES**

Practical skills: Acquisition, analysis and integration of bibliographic data. Acquisition, analysis and integration of field and laboratory data. Assessment of the working environment and specific legislation.

Intellectual skills: To identify and use theories, concepts and principles applied in sedimentary geology. To collect and integrate data, to elaborate and check hypothesis. To apply the knowledge of sedimentary geology in order to solve common and unknown problems.

Skills regarding the treatment and quantification of information: To critically analyse and synthesise information. To assess and discriminate data and analytical methods. To process and interpret data using appropriate qualitative and quantitative techniques.
Skills regarding autonomy and team work: Development of autonomy and lifelong learning. To identify objectives, and individual and collective responsibilities. To develop flexible learning and working methods, according to the circumstances.

Communication skills: To understand and use text, graphic and numerical information resources. To be able to transmit text, oral and graphic information to different types of audience.

**COURSE DESCRIPTION**

PART 1: LARGE-SCALE GEOLOGICAL PROCESSES

1. Climate and sea-level changes
2. Volcanism.
3. Tectonics (neotectonics)

PART 2: GEOLOGICAL PROCESSES IN SEDIMENTARY ENVIRONMENTS

4. Constructive processes
5. Destructive processes
6. Erosion/sedimentation balance

PART 3: SEDIMENTARY ENVIRONMENTS

7. Quaternary glaciations
8. Palaeosoils and Aeolian sediments
9. Fluvial-alluvial environments
10. Karstic environments
11. Lacustrine environments
12. Littoral environments
13. Marine environments
14. Geoarchaeology

**ASSESSMENT**

Theory and practical multiple-choice exams: 50%

Reports of field trips: 50%
TEACHING GUIDE 2018/19

Centre 908 – Master and Doctorate School

Plan ECONO802 –
Master’s Degree in Economics: Instruments of Economic Analysis

SUBJECT: 503 485 – Econometrics – ECTS Credits: 4
Econometrics

Econometrics is a compulsory subject on the Master in Economics: Instruments of Economic Analysis. It is taught simultaneously in the three universities that offer this program.

This is an intermediate-level course on the theory and practice of Econometrics. On this subject students are trained to use the linear regression model to analyse the behaviour of certain economic variables based on the data available, both cross-section and time series data. The regression model is studied in depth, with special emphasis on the alternative estimators used in case of non-compliance with the assumptions.

Econometrics deals with formulating relationships among economic variables, measuring them and validating the results obtained. It is based upon the development of statistical methods for estimating economic relationships and testing economic theories. Therefore, knowledge of linear algebra and calculus and of statistical theory (descriptive statistics, probability theory and statistical inference) is necessary to follow this course.

The main objective of this course is for the students to be able not only to design and understand economic models but to analyse economic data in order to achieve quantitative conclusions, that is, to use data to estimate economic relationships, test hypothesis, predict variables and evaluate the results of government and business policies. The linear regression model is useful and necessary for learning other advanced subjects in the degree that require the analysis of economic and business models for decision-making purposes. Moreover, since the application of econometrics methods may be found in a number of fields such as finance, marketing, accounting, labour economics, ... , the acquisition of econometric skills is a useful tool for the professional development of an economist.

Learning outcomes

The learning outcomes are directly related to the specific competences of the course and some of the cross-curricular competences of the master.

Specific competences

C1. To analyse critically the elements of the linear regression model with a view to understanding the logic of econometric modelling and being able to specify causal relationships between economic variables.

C2. To identify the relevant statistical sources in order to be able to search for, organise and systematically arrange available economic data.

C3. To apply econometric methods to estimate and validate economic relationships based on the statistical information available and using suitable IT tools.

C4. To provide reasoned interpretations for the results of estimating and validating the econometric model with a view to drawing up economic reports.

C5. To present in a clear and concise way, both orally and in writing, the conclusions obtained in an empirical application.
Cross-curricular competences

During the course, particularly in the practical sessions, the following cross-curricular competences of the module are worked on:

1. Ability to make reasoned judgements based on results obtained.
2. Development of learning abilities with a view to acquiring a high degree of autonomy for future studies and self-education.
3. Ability to communicate fluently in writing and orally.
5. Ability to communicate in a foreign language, preferably English, French or German.

Syllabus structure

In order to achieve the objectives of this course, the Linear Regression Model (LRM) is studied in detail. Thus, the main objective is for the students to be able, at the end of the course, to use the LRM to solve economic problems. This objective must be accomplished both from a theoretical and practical point of view. This implies that the students should be able to estimate and validate an econometric model with a database using the available computer tools, and to interpret the results.


a. Random variables and probability distributions
b. Foundations of mathematical statistics
c. Matrix algebra

Basic References: [G] appendices A, B, C and D.

Lesson 2. Linear Regression Model.

a. Model specification
b. Ordinary Least Squares estimation
c. Inference
   a. Small sample properties
   b. Asymptotic properties
   c. Hypothesis testing
d. Nonlinear regression functions
   a. Polynomials
   b. Logarithms
   c. Interactions between independent variables
d. Dummy variables
e. Heteroskedasticity
   a. Causes and consequences
   b. Inference robust to heteroscedasticity
c. Generalised Least Squares
Basic References: [W] chapters 2 to 8, and [S] chapters 4 to 9.

Lesson 3. Time Series Regression models

a. Comparison with cross-section regression models
b. Stationarity
c. Trend. Unit roots.
d. Regression with nonstationary time series
e. Autocorrelation

Basic References: [W] chapters 10, 11 and 14, and [S] chapters 14 and 15.

Lesson 4. Panel data

a. Model specification
b. Fixed effects
c. Random effects
d. Hypothesis testing


Assessment system

The assessment system will evaluate all the competences / learning outcomes of the course. It is based on the following activities: solving individual tasks, presenting group work assignments, participation in class, written tests and exams.

In the ordinary assessment session an ongoing evaluation system is used. It is structured as follows:

1. 50% of the grade for the subject is obtained by answering exercises, case studies and problems individually and in groups at conventional lectures, plus the work done and the evidences submitted in the practical classroom sessions. The assessment criteria will depend on the format of the evidence required (short questions, test or poster) and will be specified in each task. Since an important part to the development of the task is done in the classroom, the attitude toward learning of the students plays an important role in the assessment process.

2. 50% of the grade for the subject is obtained by means of a written exam in which students must answer short questions related to the theoretical and practical contents taught on the subject. The object is to assess whether the students have consolidated the learning outcomes required. The exam will take place simultaneously in the three universities that offer this program.

Students may decline to take part in the ordinary assessment session merely by not sitting the individual exam (50% or 100% of the grade awarded, as the case may be). Their grade will then be recorded as No Presentada / No presentado.
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. This exam will assess all the above mentioned competences (specific and cross-curricular), the degree of fulfilment of the learning outcomes as well as the contents covered in the different activities developed during the in-class period of the course. It will take place in the computer rooms.

Students may decline to take part in the extraordinary assessment session merely by not sitting the individual exam. Their grade will then be recorded as *No Presentada / No presentado*.

**References**

**Main Bibliographic References:**


**Other Bibliographic References:**


**Internet addresses of interest**

A. Software: Gretl. Opensource econometric package.


B. Institutions


C. Data websites

5. http://www.psidonline.isr.umich.edu/data/

Econometric journals (English)

1. Computational Economics
2. Econometrica
3. Econometric Reviews
4. Econometric Theory
5. Empirical Economics Journal
6. International Journal of Forecasting
7. Journal of Applied Econometrics
9. Journal of Econometrics
10. Journal of Economic Dynamics and Control
11. Journal of Forecasting
14. Review of Economic Studies
15. Studies in Nonlinear Dynamics and Econometrics

Econometric journals (Spanish)

SUBJECT
503483 - Microeconomics

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT
The aim of this course is to advance the theoretical analysis of decision-making processes of consumers and producers under the conditions of perfect competition. The course provides students with the tools necessary for the identifications of the relevant aspects of decision-making, for the application of the principles of economic theory during the diagnosis and resolution of issues arising in both professional and research activities, for making predictions regarding human and firm behavior, for the rigorous evaluation of technological constraints of firms, and for an exhaustive analysis of perfectly-competitive markets.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT
COMPETENCIAS DE LA ASIGNATURA
Modelizar el comportamiento de individuos y empresas, con o sin incertidumbre e información asimétrica.
Evaluar la consistencia teórica de las representaciones estadísticas de la demanda y oferta de un mercado competitivo.
Capacidad para la búsqueda de datos y para el análisis y síntesis de dicha información
Aplicar los principios del análisis microeconómico al diagnóstico y resolución de problemas que aparecen en el desarrollo de las actividades profesional e investigadora.
Analizar los problemas económicos con razonamiento crítico, precisión y rigor

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

THEORETICAL/PRACTICAL CONTENT
This course introduces formally microeconomic concepts and microeconomic analysis, focusing on the theories of the firm and individual behavior, supply and demand analysis, and welfare economics in the framework of perfect competition.

The theory of the consumer presents the axioms of human preferences, constructs the utility function, and analyzes formally the utility maximization problem of a consumer. With the solution of this problem in hand, we study the properties and consequences of the individual and market demand functions.

The theory of the firm introduces the concept of technology and incorporates it into the profit maximization and/or cost minimization problems of the firm. This leads to the firm's supply curve and the supply curve of the market. Their properties are analyzed in detail.

Last, we provide a microeconomic analysis of the market. We start with the partial equilibrium and follow with the general equilibrium analysis. We finish with the welfare analysis of perfectly competitive markets. We state formally the welfare theorems, and discuss their underlying assumptions and consequences.

METODOLOGIA (ACTIVIDADES FORMATIVAS)

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TYPES OF TEACHING

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Legend:

TOOLS USED & GRADING PERCENTAGES

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**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

**COMPULSORY MATERIALS**


**BIBLIOGRAPHY**

**Basic bibliography**


**In-depth bibliography**

- Macho, I. y Pérez Castrillo, D. Introducción a la teoría de la información, Editorial Ariel, 1995
- Phlips, L. Applied Consumption Analysis, North-Holland, 1974.

**Journals**

**Useful websites**

- Instituto Nacional de Estadísticas: http://www.ine.es/
- Banco de España: whhttp://www.bde.es
GAME THEORY

TEACHING GUIDE 2018/19
Centre 908 - Master and Doctorate School
Plan ECONO802 - Master's Degree in Economics: Instruments of Economic Analysis
SUBJECT: 503506 – Game Theory - ECTS Credits: 3

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.

OBJECTIVES:

To model strategic environments that are relevant in economic decision making as well as to predict the individual behavior in those strategic environments.

To introduce the main tools of experimental methodology in order to test the assumptions and predictions of individual behavior in relevant economic situations. To have a critical assessment of the assumptions behind individual utility function and the main solution concepts used in strategic environments.

RESULTS:

The idea is to learn to model a relevant decision making situation and provide a prediction regarding individual behavior, as well as to have a critical assessment of the underlying assumptions and learn about their realism when comparing how real individuals make decisions.

CONTENT:

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 and their assumptions in different solution concepts: Nash equilibrium, rationalizability, subgame perfect Nash equilibrium, Bayesian Nash equilibrium, core, 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.
EVALUATION

The final evaluation will consist of a written exam that determines the 100% of the grade in this course.

MATERIAL:

All the material will be provided in the form of slides and class notes during the main lectures.

BIBLIOGRAPHY:


FURTHER BIBLIOGRAPHY


DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

This course offers an introduction to the analysis of data that evolve over time, which require specific techniques. The basic methods and techniques are presented, with special application to economic time series and big data. It is intended that the student knows the modeling schemes of simpler time series, their limitations and possibilities of application in practice. Likewise, it is intended that the student acquires the basic theoretical foundations of the subject in order to allow for further studies in courses of advanced analysis of time series.

COMPETENCES OF THE SUBJECT

Perform 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. Perform consulting and advisory tasks in the design of business strategies and local economic policies adapted to the conditions of economic integration. Interpret and transmit the results of a quantitative analysis and prepare reports. Identify, search, organize and systematize the relevant statistical information to help explain the economic issues of interest, both at a microeconomic and macroeconomic level. Understand the logic of modeling and econometric methods for the analysis of time series and cross section data, as well as its usefulness in economic prediction. Acquire solid knowledge of modern statistical-econometric methods for the quantification of economic relations, the testing of theories and the evaluation of public policies.

THEORETICAL-PRACTICAL CONTENTS

BIBLIOGRAPHY


ACADEMIC AND SCIENTIFIC JOURNALS


SOFTWARE

### Subject

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-to-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 responsibility 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

**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.**

**Realizar tareas de consultoría y asesoramiento en el diseño de estrategias empresariales y de políticas económicas locales adaptadas a las condiciones de integración económica.**

**Manejar los métodos estadístico-econométricos diseñados para el análisis y evaluación de políticas públicas.**

**Manejar los modelos y las técnicas microeconométricas, así como los programas informáticos habituales en el análisis empírico del mercado de trabajo.**

**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.**

**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.**

### Theoretical/Practical Content

**Chapter 1. STATISTICS AND DECISION THEORY.**


Chapter 2. SELECTION CRITERIA FOR STATISTICAL PROCEDURES (I).

Chapter 3. SELECTION CRITERIA FOR STATISTICAL PROCEDURES (II).

Chapter 4. SUFFICIENCY.

Chapter 5. POINT ESTIMATION. SOME BASIC RESULTS.

Chapter 6. STOCHASTIC CONVERGENCE AND ASYMPTOTIC PROPERTIES.

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").

Chapter 8. HYPOTHESIS TESTING.

<table>
<thead>
<tr>
<th>METODOLOGIA (ACTIVIDADES FORMATIVAS)</th>
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<tbody>
<tr>
<td><strong>Actividad Formativa</strong></td>
</tr>
<tr>
<td>Teoría</td>
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<tr>
<td>Seminars</td>
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<tr>
<td>Computer practicals</td>
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<td>Classroom practicals</td>
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<td>Lectures</td>
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TYPES OF TEACHING

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<th>Type of teaching</th>
<th>M</th>
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<th>GA</th>
<th>GL</th>
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<th>GCL</th>
<th>TA</th>
<th>TI</th>
<th>GCA</th>
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<td>10</td>
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<td>5</td>
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<td>5</td>
<td>8</td>
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TOOLS USED & GRADING PERCENTAGES

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<thead>
<tr>
<th>Denominación</th>
<th>Ponderación mínima</th>
<th>Ponderación máxima</th>
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</thead>
<tbody>
<tr>
<td>Written examination</td>
<td>30 %</td>
<td>40 %</td>
</tr>
<tr>
<td>Participación en clase</td>
<td>10 %</td>
<td>20 %</td>
</tr>
<tr>
<td>Questions to discuss</td>
<td>40 %</td>
<td>60 %</td>
</tr>
</tbody>
</table>

ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
Grading in this course is based on take-home homework assigned 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.

EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT
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.

COMPULSORY MATERIALS

COMPULSORY REFERENCES:

BIBLIOGRAPHY

Basic bibliography

RECOMMENDED ADDITIONAL REFERENCES:

In-depth bibliography

ADDITIONAL REFERENCES:


**Journals**

**JOURNALS:**

- Applied Statistics
- Applied Stochastic Models in Business and Industry
- Biometrics
- Biometrika
- Biostatistics
- Communications in Statistics - Theory and Methods
- Communications in Statistics - Computation and Simulation
- 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 Research Methods for the Behavioral and Social Sciences
- Statistics in Medicine
- Statistical Methods in Medical Research
- Statistical Modelling
- The American Statistician

**Useful websites**

**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/)
DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

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

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.

LEARNING RESULTS FOR THE SUBJECT

- Identify an optimization problem in the field of chemical engineering.
- Define an optimization problem (linear, integer or non-linear)
- Select the appropriate optimization method for the resolution of each problem.
- Implement the optimization method and solve the problem using appropriate calculation software.

- Analyze the result of an optimization problem.

THEORETICAL/PRACTICAL CONTENT

INTRODUCTION: Formulation of an optimization problem; types of problems; Review of basic techniques.

LINEAR PROGRAMMING: Problem definition. Simplex Algorithm. Examples and applications in Chemical Engineering.


<table>
<thead>
<tr>
<th>METODOLOGIA (ACTIVIDADES FORMATIVAS)</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
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<tbody>
<tr>
<td>Presentation and defence of projects</td>
<td>5</td>
<td>100 %</td>
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<tr>
<td>Exercises</td>
<td>10</td>
<td>20 %</td>
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<tr>
<td>Expository classes</td>
<td>15</td>
<td>100 %</td>
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<tr>
<td>Handling sources and resources</td>
<td>17.6</td>
<td>0 %</td>
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<tr>
<td>Groupwork</td>
<td>30</td>
<td>30 %</td>
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<tr>
<td>Case analysis</td>
<td>35</td>
<td>40 %</td>
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<th>TYPES OF TEACHING</th>
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<tr>
<td>Type of teaching</td>
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<tr>
<td>Classroom hours</td>
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<tr>
<td>Hours of study outside the classroom</td>
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<tr>
<th>LEGEND</th>
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<tbody>
<tr>
<td>M: Lecture</td>
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<tr>
<td>S: Seminar</td>
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<tr>
<td>GA: Pract. Class. Work</td>
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<tr>
<td>GL: Pract. Lab. Work</td>
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<tr>
<td>GO: Pract. Computer Work</td>
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<tr>
<td>TI: Ind. Workshop</td>
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<tr>
<td>TA: Workshop</td>
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<td>GCA: Field Workshop</td>
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<tr>
<th>TOOLS USED &amp; GRADING PERCENTAGES</th>
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<tr>
<td>Denominación</td>
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<tr>
<td>Written examination</td>
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<tr>
<td>Presentations</td>
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<td>Practical tasks</td>
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ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT

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 EXAM CALL: GUIDELINES & DECLINING TO SIT

In the extraordinary assessment call, students will have take and exam and submit and present an individual work on optimization.
DESCRIPTION AND CONTEXTUALIZATION OF THE SUBJECT

This course studies the design, manufacture and application of the natural and synthetic polymeric materials, called biomaterials, for applications in a wide variety of implants, devices or equipments that have contact with biological systems.

COMPETENCES / LEARNING OUTCOMES OF THE SUBJECT

As a result of the course, the student has to be able to choose specific techniques or instruments to address a problem of biomaterial behaviour in a specific physiological environment and to acquire a basic knowledge that provides a basis for the research and development of new polymeric biomaterials.

THEORETICAL-PRACTICAL CONTENTS

1.-Introduction and historic development
2.-Polymeric systems
3.-Biocompatibility
4.-Polymers for ophtalmology
5.-Drug controlled release systems. Nanosystems
6.-Sutures and surgical adhesives
7.-Biodegradable polymers for tissue regeneration. Principles of tissue engineering
8.-Applications in dermatology
9.-Plastic and reconstructive surgery
10.-Haemocompatible polymers
11.-Implants for muskuloskeletal system
12.-Polymers for odontology

TOOLS USED & GRADING PERCENTAGES

Others: Throughout the course, the students will pass a continuous evaluation which includes active participation in class, interest shown by the subject and own and originals contributions to the class.

COMPULSORY MATERIALS

Not required
BIBLIOGRAPHY

BASIC BIBLIOGRAPHY
- BIOMATERIALS SCIENCE. AN INTRODUCTION TO MATERIALS IN MEDICINE, Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, editors Elsevier, Oxford (UK) 2013

ADVANCED BIBLIOGRAPHY
The student will be provided with recent articles about various aspects of each topic.

JOURNALS
Biomaterials
Journal of Biomedical Materials Research. Part A
Journal of Biomedical Materials Research Part B
Journal of Materials Science. Materials in Medicine

WEBSITES
The student will be provided with different website addresses along the course.
DESCRIPTION AND CONTEXTUALIZATION OF THE SUBJECT

The main objective of this course is to provide the student with a combination of current scientific knowledge in various fields of polymers applications, with a vision of applied technology. A especial attention is payed to two types of applications, one of them in structural materials, composite materials or composites, and the other in functional materials, coatings and adhesives. This will allow the student to get on in the industry, either in companies that supply raw materials for the different applications, or in those in which they have to perform the different formulations, the processing, or the final application.

COMPETENCES / LEARNING OUTCOMES OF THE SUBJECT

At the end of the course, the student has to be able to obtain information about advanced materials from the specialized bibliography and through the contact with others specialists in the field. Additionaly, they have to be able to choose a polymeric material to address a certain problem and know and distinguish different materials suitable for use in different applications.

THEORETICAL-PRACTICAL CONTENTS

1.-Industrial applications of polymers
2.-Composites: general concepts
3.-Polymeric composites components
4.-Processing and properties of polymeric composites
5.-Applications of polymeric composites
6.-Coatings and adhesives: general concepts
7.-Resins and other components
8.-Adhesion. Mechanisms and adhesion tests
9.-Coatings properties
10.-Industrial applications of coatings and adhesives

COMPULSORY MATERIALS

Not required
BIBLIOGRAPHY

BASIC BIBLIOGRAPHY

ADVANCED BIBLIOGRAPHY
The student will be provided with recent articles about various aspects of each topic.

JOURNALS
Journal of Applied Polymer Science
Progress in Organic Coatings
Journal of Paint Technology
Surface and Coating Technology
Polymer Composites
Composites Science and Technology
Composites Part A, Applied Science

WEBSITES
The student will be provided with different website addresses along the course.
SUBJECT

504107 - Advanced Techniques in Polymer Processing and Optimization by Computer-Aided Simulation

DESCRIPTION & CONTEXTUALISATION OF THE SUBJECT

After a brief introduction to the main techniques used for the processing of polymeric materials, already studied in previous academic courses, the subject delves into current trends and innovations related to these techniques. A module dedicated exclusively to the processing of elastomeric materials is also included. Finally, taking the injection molding process as an example, the subject works in depth the optimization of this technique, by using a CAE analysis software specially designed for that purpose.

The course includes laboratory work sessions, where the students will operate some typical processing techniques; computer practices related to assisted simulation, and seminars, in which students will present the results obtained in the previous teaching methods.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCIAS DE LA ASIGNATURA

Saber reconocer la técnica industrial de procesado adecuada para cada tipo de material polimérico y/o para la fabricación de piezas poliméricas.

Haber adquirido conocimientos sobre las técnicas más actuales y destrezas en el manejo de las técnicas fundamentales de procesado de materiales poliméricos.

Adquirir destrezas en el manejo, interpretación y comunicación de resultados obtenidos mediante softwares de simulación de procesado de materiales poliméricos.

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

THEORETICAL/PRACTICAL CONTENT

Topic 1. Fundamentals of polymeric material processing techniques.


Topic 3. Advances in injection molding: Fluid-assisted injection (water, gas), structural foams, overmolding, lost-core molding, injection-compression, microcellular foams ...


Topic 5. Innovations and advanced techniques for extrusion, thermoforming and rotational molding.


Topic 7. Simulation of computer assisted injection molding: Introduction to software by finite elements. Information about materials and processes necessary for the simulation. Launching and realization of simulations, and analysis of the results.

METODOLOGIA (ACTIVIDADES FORMATIVAS)

<table>
<thead>
<tr>
<th>Actividad Formativa</th>
<th>Horas</th>
<th>Porcentaje presencialidad</th>
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<tbody>
<tr>
<td>Reading and practical analysis</td>
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<tr>
<td>Expositive classes</td>
<td>20</td>
<td>100 %</td>
</tr>
<tr>
<td>Acquiring basic instrumental skills</td>
<td>25</td>
<td>40 %</td>
</tr>
<tr>
<td>Solving practical cases</td>
<td>30</td>
<td>40 %</td>
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<tr>
<td>Text analysis</td>
<td>30</td>
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**TYPES OF TEACHING**

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<th>Type of teaching</th>
<th>M</th>
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<th>GA</th>
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<th>TA</th>
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<th>GCA</th>
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<tbody>
<tr>
<td>Classroom hours</td>
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<td>10</td>
<td>12</td>
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<td>18</td>
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Legend:
- M: Lecture
- S: Seminario
- GA: Pract.Class.Work
- GL: Pract.Lab work
- GO: Pract.computer wo
- GCL: Clinical Practice
- TA: Workshop
- TI: Ind. workshop
- GCA: Field workshop

**TOOLS USED & GRADING PERCENTAGES**

<table>
<thead>
<tr>
<th>Denominación</th>
<th>Ponderación mínima</th>
<th>Ponderación máxima</th>
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<tr>
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<td>50 %</td>
<td>70 %</td>
</tr>
<tr>
<td>Presentations</td>
<td>30 %</td>
<td>50 %</td>
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</table>

**ORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

- Written exam of the theoretical contents: 60%
- Continuous evaluation and evaluation of the written report of the laboratory practices: 20%
- Continuous evaluation and evaluation of the presentation of the practical computer work: 20%

*No show* will be given to students which do not attend to the written exam of theoretical contents, which means the automatic waiver of the call.

**EXTRAORDINARY EXAM CALL: GUIDELINES & DECLINING TO SIT**

The parts graded No pass/failed in the ordinary exam call will be re-examined, by using the same methods than in the ordinary exam call.

*No show* will be given to students which do not attending the exam, which means the automatic waiver of the call.

**COMPULSORY MATERIALS**

No compulsory materials are needed.

**BIBLIOGRAPHY**

**Basic bibliography**

2. J. F. STEVENSON (ED.), INNOVATION IN POLYMER PROCESSING: MOLDING. HANSER, NEW YORK, 1996.
6. MANUALES DE USUARIO DE LOS SOFTWARES IRONCAD, DESKARTES 3DATA EXPERT Y CADMOULD.

**In-depth bibliography**

**Journals**

- POLYMER ENGINEERING AND SCIENCE
- INTERNATIONAL POLYMER PROCESSING
- PLASTICOS UNIVERSALES
- JOURNAL OF APPLIED POLYMER SCIENCE
- RUBBER CHEMISTRY AND TECHNOLOGY

**Useful websites**

Web sites, which will be announced through the course