

## [GMG302] PROCESS ENGINEERING

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN MECHANICAL ENGINEERING		<b>Subject</b>	MANUFACTURING PROCESS ENGINEERING
<b>Semester</b>	2	<b>Course</b>	2	<b>Mention / Field of specialisation</b>
<b>Character</b>	COMPULSORY		<b>Language</b>	CASTELLANO/EUSKARA
<b>Plan</b>	2022	<b>Modality</b>	Face-to-face	<b>Total hours</b>
<b>Credits</b>	4,5	<b>Hours/week</b>	3,75	67.5 class hours + 45 non-class hours = <b>112.5 total hours</b>

### PROFESSORS

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### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
GRAPHIC EXPRESSION II	Trigonometry notions
DEVELOPMENT TECHNOLOGY	
FOUNDATIONS OF MATERIALS SCIENCE	

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>GMR210</b> - To know and apply manufacturing, metrology and quality control systems and processes		x		4,02
<b>G-RTR1</b> - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and /or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy		x		0,24
<b>G-RTR2</b> - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language		x		0,24
<b>Total:</b>				<b>4,5</b>

*KC: Knowledge or Content / SK: Skills / AB: Abilities*

#### ENAE LEARNING RESULTS

- ENA102** - Knowledge and comprehension: Knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree, including notions of the latest advances.
- ENA103** - Knowledge and comprehension: Awareness of the multidisciplinary context of engineering.
- ENA104** - Analysis in engineering: The ability to analyse complex products, processes and systems in their field of study; choose and apply relevant analytical, calculation and experimental methods in a suitable way; and correctly interpret the results of such analyses.
- ENA105** - Analysis in engineering: The ability to identify, formulate and solve engineering problems in their speciality; choose and apply adequately established analytical, calculation and experimental methods; and acknowledge the importance of social, health and safety, environmental, economic, and industrial restrictions.
- ENA106** - Engineering projects: Ability to project, design and develop complex products (parts, components, finished products, etc.), processes and systems of their speciality, which meet the established requirements, including awareness of the social, health and safety, environmental, economic and industrial aspects, as well as selecting and applying appropriate project methods.
- ENA109** - Research and innovation: Ability to consult and apply codes of good practice and security in their speciality.
- ENA110** - Research and innovation: Capacity and ability to project and carry out experimental investigations, interpret results, and reach conclusions in their field of study.
- ENA111** - Practical application of engineering: Understanding of the applicable techniques and methods for analysis, design and research and their limitations in the field of their speciality.
- ENA112** - Practical application of engineering: Practical competency to solve complex problems, carry out complex engineering projects, and conduct investigations specific to their speciality.
- ENA113** - Practical application of engineering: Knowledge of application of materials, equipment and tools, engineering technology and processes, and their limitations in the field of their speciality.
- ENA114** - Practical application of engineering: Ability to apply standards of engineering practice in their speciality.
- ENA115** - Practical application of engineering: Knowledge of the social, health and safety, environmental, economic and industrial implications of engineering practice.
- ENA118** - Preparation of judgements: Ability to manage complex technical or professional activities or projects of their speciality, taking responsibility for decision making.
- ENA119** - Communication and Teamwork: Ability to effectively communicate information, ideas, problems and solutions in the field of engineering and with society in general.
- ENA120** - Communication and Teamwork: Ability to operate effectively in domestic and international contexts, individually and as a team, and to cooperate with both engineers and people from other disciplines.

### SECONDARY LEARNING RESULTS

**RGM231** [!] *Crear hojas de procesos de mecanizado económicas teniendo en cuenta las tecnologías aditivas y el mecanizado con máquinas convencionales y CNC*

**LEARNING ACTIVITIES**

	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	1 h.	12 h.	13 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.		2 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	17 h.	2 h.	19 h.
Carrying out exercises and solving problems individually and/or in teams	5 h.	3,5 h.	8,5 h.

**EVALUATION SYSTEM**

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%
Individual written and/or oral tests or individual coding/programming tests	50%

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests  
**Comments:** The first exam will have a weight of 25 % and the make-up will have a weight of 75 %.

**CH - Class hours:** 25 h.  
**NCH - Non-class hours:** 17,5 h.  
**TH - Total hours:** 42,5 h.

**RGM291** [!] *Establecer las responsabilidades de los miembros del equipo utilizando técnicas adecuadas para fomentar la eficiencia del equipo para el desarrollo del proyecto en los plazos establecidos (compartir recursos, aportar ideas, habilidades comunicativas)*

**LEARNING ACTIVITIES**

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	2 h.	1 h.	3 h.

**EVALUATION SYSTEM**

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%
Co-assessment	50%

**MAKE-UP MECHANISMS**

(No mechanisms)  
**Comments:** The evaluation of the semester project will be continuous and will be based on the meetings of the team with the tutor and the experts. One week before the final delivery of the report, the work as a whole will be analysed, the necessary improvements will be defined and communicated to the team. Improvements must be made before the delivery of the final version of the report.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM290** [!] *Proponer los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías propias de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrategia de aprendizaje*

**LEARNING ACTIVITIES**

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	2 h.	1 h.	3 h.

**EVALUATION SYSTEM**

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory	100%

**MAKE-UP MECHANISMS**

(No mechanisms)  
**Comments:** The evaluation of the semester project will be

exercises, term projects, challenges and problems  
**Comments:** Students have the responsibility of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals.

continuous and will be based on the meetings of the team with the tutor and the experts. One week before the final delivery of the report, the work as a whole will be analysed, the necessary improvements will be defined and communicated to the team. Improvements must be made before the delivery of the final version of the report.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM230 [!]** *Crear hojas de proceso de fresado y taladrado, y crear manualmente sus programas CNC*

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	1 h.	14 h.	15 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	1 h.		1 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	14,5 h.	1 h.	15,5 h.
Carrying out exercises and solving problems individually and/or in teams	4 h.	2 h.	6 h.

**Comments:** The occupational safety aspects related to machining processes are mentioned and the effects that may be generated on the environment are analysed. The costs of machining processes are worked out, calculating machining times and hourly rates.

**EVALUATION SYSTEM**

	<i>W</i>
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	85%
Individual written and/or oral tests or individual coding/programming tests	15%

**MAKE-UP MECHANISMS**

Individual written and/or oral tests or individual coding/programming tests  
**Comments:** The first exam will have a weight of 25% and the make-up will have a weight of 75%.

**CH - Class hours:** 20,5 h.  
**NCH - Non-class hours:** 17 h.  
**TH - Total hours:** 37,5 h.

**RGM293 [!]** *Redacta y estructura correctamente la memoria del proyecto, haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje. Para ello, busca y hace uso de las fuentes de información adecuadas.*

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	2 h.	1 h.	3 h.

**EVALUATION SYSTEM**

	<i>W</i>
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%

**MAKE-UP MECHANISMS**

(No mechanisms)  
**Comments:** The evaluation of the semester project will be continuous and will be based on the meetings of the team with the tutor and the experts. One week before the final delivery of the report, the work as a whole will be analysed, the necessary improvements will be defined and communicated to the team. Improvements must be made before the delivery of the final version of the report.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM294** [!] *Realiza una presentación oral del proyecto con argumentos elaborados por sí mismos y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

**LEARNING ACTIVITIES**

	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	2 h.	1 h.	3 h.

**EVALUATION SYSTEM**

**W**

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

**Comments:** Students have the responsibility of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals.

**MAKE-UP MECHANISMS**

*(No mechanisms)*

**Comments:** The evaluation of the semester project will be continuous and will be based on the meetings of the team with the tutor and the experts. One week before the final delivery of the report, the work as a whole will be analysed, the necessary improvements will be defined and communicated to the team. Improvements must be made before the delivery of the final version of the report.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM232** [!] *Crear y defender hojas de procesos de mecanizado económicos haciendo un uso básico de la fabricación asistida por ordenador*

**LEARNING ACTIVITIES**

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	14 h.	6,5 h.	20,5 h.

**EVALUATION SYSTEM**

**W**

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

Individual written and/or oral tests or individual coding/programming tests

**Comments:** Students have the responsibility of meeting the experts to do the tracking of the project and to ensure the achievement of the goals.

**MAKE-UP MECHANISMS**

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

Individual written and/or oral tests or individual coding/programming tests

**Comments:** The evaluation of the semester project will be continuous and will be based on the meetings of the team with the tutor and the experts. One week before the final delivery of the report, the work as a whole will be analysed, the necessary improvements will be defined and communicated to the team. Improvements must be made before the delivery of the final version of the report.

**CH - Class hours:** 14 h.  
**NCH - Non-class hours:** 6,5 h.  
**TH - Total hours:** 20,5 h.

**CONTENTS**

1.- Conventional Material Removal Processes

- Drilling: machines and operations
- Milling: machines and operations
- Turning: machines and operations
- Coolants
- Cutting tools: materials and geometry
- Cutting tool selection

Machining times

Cutting force and power

Grinding processes

Process planning

2.- Other Processes:

Additive Manufacturing (AM)

Electro Discharge Machining (EDM)

High Speed Milling (HSM)

3.- Computer aided tools for manufacturing

FAGOR CNC programming

CAM programming

## LEARNING RESOURCES AND BIBLIOGRAPHY

### Learning resources

Subject notes  
Labs  
Moodle Platform  
Lab practical training  
Class presentations  
Specific Master Software

### Bibliography

Halevi, G. (2003). Process and Operation Planning : Revised Edition of the Principles of Process Planning: a Logical Approach. Springer Netherlands.  
Scallan, P. (2003). Process Planning: The Design/Manufacture Interface. Elsevier  
Kalpakjian, S., & Schmid, S. R. (2002). Manufactura, ingeniería y tecnología. Pearson educación.  
Grover, M. P. (1997). Fundamentos de Manufactura Moderna. Materiales, Procesos y Sistemas.