

[GED302] MICROPROCESSORS

GENERAL INFORMATION

Studies	DEGREE IN INDUSTRIAL ELECTRONICS ENGINEERING		Subject	INDUSTRIAL COMPUTING
Semester	2	Course	2	Mention / Field of specialisation
Character	COMPULSORY		Language	CASTELLANO/EUSKARA
Plan	2022	Modality	Face-to-face	Total hours
Credits	4,5	Hours/week	4.17	75 class hours + 37.5 non-class hours = 112.5 total hours

PROFESSORS

GARRO ARRAZOLA, UNAI
OSA AROZENA, JOSEBA

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
FUNDAMENTALS OF COMPUTING SCIENCE	C Programming Language

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GER213 - To know the fundamentals and applications of digital electronics and microprocessors		x		4,02
G-RTR1 - 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
G-RTR2 - 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
Total:				4,5

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

ENAE LEARNING RESULTS

- ENA103** - Knowledge and comprehension: Awareness of the multidisciplinary context of engineering.
- 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.
- 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.
- ENA117** - Preparation of judgements: Ability to collect and interpret data and handle complex concepts within their speciality, in order to make judgements that involve reflection on ethical and social issues.
- 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

[RGE290] [!] *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 aprendiz*

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	MAKE-UP MECHANISMS	

Observation (technical capacity, attitude and participation) 100%

Observation (technical capacity, attitude and participation)

Comments: Continuous assessment.

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

RGE291 [!] *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

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
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

Observation (technical capacity, attitude and participation) 100%

MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

Comments: Continuous assessment.

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

RGE293 [!] *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

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems 100%

MAKE-UP MECHANISMS

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

Comments: - Continuous assessment. - It may be asked to redo the document.

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

RGE294 [!] *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

	<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

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 100%

MAKE-UP MECHANISMS

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: - Continuous assessment.

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

RGE236 [!] *Realiza el esquema electrónico de un sistema lógico basado en microprocesador*

LEARNING ACTIVITIES

	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.		2 h.
Computer simulation exercises, individually and/or in teams	4 h.	4 h.	8 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	12 h.	4 h.	16 h.

EVALUATION SYSTEM

Individual written and/or oral tests or individual coding/programming tests
Comments: - Control point: minimum grade 5.

W

100%

MAKE-UP MECHANISMS

Individual written and/or oral tests or individual coding/programming tests
Comments: - Students with less than a 5 at the control point must retake the exam. - Final grade of the control point: control point 25% and retake 75%.

CH - Class hours: 18 h.
NCH - Non-class hours: 8 h.
TH - Total hours: 26 h.

RGE237 [!] *Selecciona un microprocesador/microcontrolador para una aplicación concreta*

LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out work experience in real environments and writing the corresponding report	14 h.	8 h.	22 h.

EVALUATION SYSTEM

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
Prototype / Product

W

20%

50%

30%

Comments: - PBL project grade: 30% product, 20% technical content of the report and 50% individual technical defense.

MAKE-UP MECHANISMS

Prototype / Product
Comments: - In the project / PBL there will not be any retake of the individual defense.

CH - Class hours: 14 h.
NCH - Non-class hours: 8 h.
TH - Total hours: 22 h.

RGE238 [!] *Realiza el desarrollo SW completo de una aplicación basada en microprocesador, diagnosticando y corrigiendo problemas de hardware en un circuito impreso*

LEARNING ACTIVITIES

	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.		2 h.
Computer simulation exercises, individually and/or in teams	10 h.	7,5 h.	17,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	23 h.	10 h.	33 h.

EVALUATION SYSTEM	W	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: - Control point: minimum grade 5. - Courseworks: minimum grade 5.	15% 85%	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: - Students with less than a 5 at the control point must retake the exam. - Final note of the control point: control point 25% and retake 75%. - For the courseworks, their correction will be asked. The maximum mark for the corrected courseworks will be 5.0.
CH - Class hours: 35 h. NCH - Non-class hours: 17,5 h. TH - Total hours: 52,5 h.		

CONTENTS

1 - Bases
 1.1 What is a microcontroller?
 1.2 Microcontroller families
 1.3 Microcontroller applications
 1.4 Microcontroller boards: design, analysis and peripherals
 2 - Architecture of microcontrollers
 2.1 Architecture of microcontrollers
 2.2 Execution sequence (Pipeline)
 2.3 Peripherals and memory map
 3 - Clocks and Timers
 3.1 Timer functions
 3.2 Clock system
 3.3 Timers
 3.4 PLL, Timers and Prescalers
 3.5 SysTick Timer in Cortex M4
 3.6 TIM6 and TIM7 in STM32F4xx
 4 - Interrupts and exceptions
 5 - Other peripherals

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Labs Specific Master Software Moodle Platform	Balagurusamy, 2010, "Programming in ANSI C", Tata McGraw-Hill Education Texas Instruments, 2013, "MCU Product Search", Texas Instruments Incorporated, 2013 Jivan S. Parab and al., "Practical Aspects of Embedded System Design using Microcontrollers". Springer. 2008. ISBN: 978-9048178650 STM32F405/415, STM32F407/417, STM32F427/437 and STM32F429/439, RM0090 Reference Manual, STMicroelectronics, February 2019 STM32F405xx STM32F407xx Datasheet, STMicroelectronics, September 2016 Computer Organization and Design: The Hardware/Software Interface, Third Edition, D.A. Patterson and J. L. Hennessy, Elsevier 2005