[GED303] INDUSTRIAL COMPUTING AND COMMUNICATIONS

GENERAL INFORMATION

Studies	DEGREE IN INDUSTRIAL ELECTRONICS ENGINEERING			**Subject**	?
Semester	2	**Course**	3	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2022	**Modality**	Face-to-face	**Language**	EUSKARA/CASTELLANO
Credits	6	**Hours/week**	5.22	**Total hours**	94 class hours + 56 non-class hours = **150 total hours**

2030 AGENDA GOALS

PROFESSORS

FERNANDEZ ARRIETA, MIGUEL

OSA AROZENA, JOSEBA

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
(No specific previous subjects required)	*(No previous knowledge required)*

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GER310 - To know and apply industrial computing and communications		*x*		5,08
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*		0,44
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*		0,48
			Total:	6

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

ENAEE LEARNING RESULTS

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.

ENA107 - Engineering projects: Project capacity some state-of-the-art knowledge of their engineering speciality.

ENA108 - Research and innovation: Ability to carry out bibliographic searches and consult and use databases and other information sources with discretion, in order to carry out simulation and analysis with the aim of conducting research on technical topics of their speciality.

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 fr 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.

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.

ENA121 - Continued training: Ability to acknowledge the need for their own continued training and to undertake this activity throughout their professional life independently.

ENA122 - Continued training: Ability to stay up to date on science and technology innovations.

SECONDARY LEARNING RESULTS

2RGE392 **(2 sem)**

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

RGE326 **[!]** ***Diseña el sistema de comunicación en un sistema de control distribuido***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints		3 h.	3 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	5 h.		5 h.
Carrying out exercises and solving problems individually and/or in teams	3 h.	3 h.	6 h.
Practical work in workshops and/or laboratories, individually and/or in teams	5 h.		5 h.
Carrying out work experience in real environments and writing the corresponding report	5 h.	4 h.	9 h.

Comments: *Cutting-edge communications architectures and protocols used in the industry are worked on.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	40,4%
Individual written and/or oral tests or individual coding/programming tests	50%
Prototype / Product	9,6%

Comments: - Control point: minimum grade 5. - Courseworks: minimum grade 5. - PBL project grade: 30% product, 20% technical content of the report and 50% individual technical defense.

MAKE-UP MECHANISMS

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

Prototype / Product

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

CH - Class hours: 18 h.
NCH - Non-class hours: 10 h.
TH - Total hours: 28 h.

2RGE393 **(2 sem)**

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	4 h.	2 h.	6 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies,	100%

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer

computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

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

CH - Class hours: 4 h.
NCH - Non-class hours: 2 h.
TH - Total hours: 6 h.

RGE324 **[!]** ***Desarrolla y valida la arquitectura HW/SW diseñada en base a unos requisitos***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	1 h.	5 h.	6 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	7 h.		7 h.
Practical work in workshops and/or laboratories, individually and/or in teams	5 h.	2 h.	7 h.
Carrying out work experience in real environments and writing the corresponding report	6 h.	3 h.	9 h.

Comments: *Cutting-edge communications architectures and protocols used in the industry are worked on.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	6,2%
Individual written and/or oral tests or individual coding/programming tests	84,5%
Prototype / Product	9,3%

Comments: - Control point: minimum grade 5. - PBL project grade: 30% product, 20% technical content of the report and 50% individual technical defense.

MAKE-UP MECHANISMS

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

Prototype / Product

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%. - In the project / PBL there will not be any retake of the individual defense.

CH - Class hours: 19 h.
NCH - Non-class hours: 10 h.
TH - Total hours: 29 h.

2RGE390 **(2 sem)**

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.	2 h.	4 h.

EVALUATION SYSTEM	W
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: 2 h.
TH - Total hours: 4 h.

2RGE394 **(2 sem)**

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	4 h.	2 h.	6 h.

individually and/or in teams

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	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: 4 h.
NCH - Non-class hours: 2 h.
TH - Total hours: 6 h.

RGE323 **[!]** ***Diseña, justifica, la arquitectura HW y SW de una aplicación en base a unos requisitos***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	4 h.	7 h.	11 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	13 h.		13 h.
Carrying out work experience in real environments and writing the corresponding report	4 h.	5 h.	9 h.

Comments: *Cutting-edge communications architectures and protocols used in the industry are worked on.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	6%
Individual written and/or oral tests or individual coding/programming tests	86%
Prototype / Product	8%

Comments: - Control point: minimum grade 5. - PBL project grade: 30% product, 20% technical content of the report and 50% individual technical defense.

MAKE-UP MECHANISMS

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

Prototype / Product

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%. - In the project / PBL there will not be any retake of the individual defense.

CH - Class hours: 21 h.
NCH - Non-class hours: 12 h.
TH - Total hours: 33 h.

2RGE391 **(2 sem)**

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.	2 h.	4 h.

EVALUATION SYSTEM	W
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: 2 h.
TH - Total hours: 4 h.

RGE325 **[!]** ***Compara prestaciones y selecciona redes locales y buses de campo industriales.***

LEARNING ACTIVITIES	CH	NCH	TH

Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints		6 h.	6 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	6 h.		6 h.
Carrying out exercises and solving problems individually and/or in teams	6 h.	4 h.	10 h.
Practical work in workshops and/or laboratories, individually and/or in teams	5 h.		5 h.
Carrying out work experience in real environments and writing the corresponding report	6 h.	4 h.	10 h.

Comments: *Cutting-edge communications architectures and protocols used in the industry are worked on.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	41,9%
Individual written and/or oral tests or individual coding/programming tests	50%
Prototype / Product	8,1%

Comments: - Control point: minimum grade 5. - Courseworks: minimum grade 5. - PBL project grade: 30% product, 20% technical content of the report and 50% individual technical defense.

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

Prototype / Product

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

CH - Class hours: 23 h.
NCH - Non-class hours: 14 h.
TH - Total hours: 37 h.

CONTENTS

I. Industrial Communications

1. Communications architecture
    1. Local networks and wide area networks
    2. TCP/IP
    3. Ethernet networks IEEE 802.3
    4. Wireless networks IEEE 802.11.
2. Industrial Ethernet
    1. Deterministic protocols
        1. Profinet
        2. IWLAN.
        3. Other protocols: Powerlink, EtherCAT.
    2. Redundant networks
    3. Network integration: OPC-UA, MQTT.

II. Industrial Computing

1. Objectives
2. Presentation of V-model
3. Problem specifications
    1. Security requirements
    2. Reliability requirements
    3. Economic requirements
    4. Functional requirements
4. HW Architecture: CPU System, selection of materials and sensors.
    1. Application context diagram
    2. Hardware context diagram
    3. Selection of sensors and other HWs
    4. Selection of software
    5. Accurate hardware context diagram
5. SW Architecture: Definition of tasks and responsibilities
6. SW Implementation
    1. Sequential programming based on interruptions
    2. Multitasking on RTOS
    3. Specific programming platforms: Verification and validation
7. Verification
8. Validation: Life cycle management
9. Version control and product updates
10. Maintenance

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Subject notes
Moodle Platform
Lab practical training
Computer practical training
[!] *Garapen ingurune integratua: Keil MDK-ARM v5.13*

Bibliography

Rajan, Ajitha, Wahl, Thomas (Eds.) "CESAR - Cost-efficient Methods and Processes for Safety-relevant Embedded Systems". Springer. 2013. ISBN: 978-3-7091-1387-5

William Stallings. "Operating Systems: Internals and Design Principles (8th Edition)". Pearson. ISBN-13: 978-0133805918

Herman Bruyninckx. "Real-Time and Embedded Guide" 2002 URL: http://people.mech.kuleuven.be/~bruyninc/rthowto/

Tanenbaum, Andrew S. Computer networks (4th ed). New Jersey Pearson Education. 2003. ebook. ISBN: 0-13-038488-7

Couch, Leon W. II. "Digital and Analog Communication Systems" 5ªed. Maxwell MacMillan international Editions. New Jersey. 1997

Stallings, William. "Handbook of Computer Communications Standards", Howard W. Sams & Company, 1987

Campbell, Joe. "C Programmers Guide to Serial Communications". SAMS. 1987