

## [GEK301] POWER ELECTRONICS

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN INDUSTRIAL ELECTRONICS ENGINEERING		<b>Subject</b>	?
<b>Semester</b>	1	<b>Course</b>	3	<b>Mention / Field of specialisation</b>
<b>Character</b>	COMPULSORY		<b>Language</b>	EUSKARA/CASTELLANO/ENGLISH
<b>Plan</b>	2022	<b>Modality</b>	Face-to-face	<b>Total hours</b> 72 class hours + 40.5 non-class hours = <b>112.5 total hours</b>
<b>Credits</b>	4,5	<b>Hours/week</b>	4	

### 2030 AGENDA GOALS



### PROFESSORS

MILIKUA URZELAI, ARITZ  
MARZO ELGUERO, IOSU

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
ELECTRONIC TECHNOLOGY	(No previous knowledge required)
BASICS OF ANALOGUE ELECTRONICS	

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>GER302</b> - To know and apply power electronics		x		3,78
<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		0,4
<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		0,32
<b>Total:</b>				<b>4,5</b>

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

### ENAAE LEARNING RESULTS

- ENA102** - Knowledge and comprehension: Knowledge and comprehension of the engineering disciplines of their specialty, at the level necessary to acquire the rest of the competencies of the degree, including notions of the latest advances.
- 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 specialty; 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 specialty, 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 specialty.
- 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 specialty.
- ENA109** - Research and innovation: Ability to consult and apply codes of good practice and security in their specialty.
- 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 specialty.
- ENA112** - Practical application of engineering: Practical competency to solve complex problems, carry out complex engineering projects, and conduct investigations specific to their specialty.
- 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 specialty.
- 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 specialty, 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

### **RGE305** [!] *Analiza convertidores estáticos AC-DC, DC-DC y DC-AC.*

#### LEARNING ACTIVITIES

	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	5 h.	7 h.
Computer simulation exercises, individually and/or in teams	4 h.	6 h.	10 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.
Carrying out exercises and solving problems individually and/or in teams	4 h.	6 h.	10 h.

#### EVALUATION SYSTEM

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	40%
Individual written and/or oral tests or individual coding/programming tests	60%

**Comments:** - Control point: minimum grade 5. - Courseworks: minimum grade 5. - To calculate the average grade, the minimum grade for each evaluation system must be 3.0, otherwise the lowest grade will be applied.

#### 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:** - 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:** 30 h.

**NCH - Non-class hours:** 17 h.

**TH - Total hours:** 47 h.

### **RGE306** [!] *Diseña e implementa convertidores electrónicos de potencia*

#### LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out work experience in real environments and writing the corresponding report	17 h.	10 h.	27 h.

#### EVALUATION SYSTEM

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	20%
Individual written and/or oral tests or individual coding/programming tests	50%
Prototype / Product	30%

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

#### MAKE-UP MECHANISMS

Prototype / Product

**Comments:** There will not be any retake of the individual defense.

**CH - Class hours:** 17 h.

**NCH - Non-class hours:** 10 h.

**TH - Total hours:** 27 h.

### **1RGE390** (1 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	4 h.		4 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:** 4 h.

**NCH - Non-class hours:** 0 h.

**TH - Total hours:** 4 h.

**1RGE394 (1 sem)**

**LEARNING ACTIVITIES**

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

**CH**

1 h.

**NCH**

3 h.

**TH**

4 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

**W**

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:** 1 h.

**NCH - Non-class hours:** 3 h.

**TH - Total hours:** 4 h.

**1RGE391 (1 sem)**

**LEARNING ACTIVITIES**

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

**CH**

3 h.

**NCH**

**TH**

3 h.

**EVALUATION SYSTEM**

Observation (technical capacity, attitude and participation) 100%

**W**

100%

**MAKE-UP MECHANISMS**

Observation (technical capacity, attitude and participation)

**Comments:** Continuous assessment

**CH - Class hours:** 3 h.

**NCH - Non-class hours:** 0 h.

**TH - Total hours:** 3 h.

**1RGE393 (1 sem)**

**LEARNING ACTIVITIES**

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

**CH**

2 h.

**NCH**

2 h.

**TH**

4 h.

**EVALUATION SYSTEM**

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

**W**

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:** 2 h.  
**TH - Total hours:** 4 h.

**1RGE392 (1 sem)**

**LEARNING ACTIVITIES**

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

**CH**

3 h.

**NCH**

**TH**

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:** 3 h.  
**NCH - Non-class hours:** 0 h.  
**TH - Total hours:** 3 h.

**RGE304 [!] *Calcula valores medios, eficaces, potencias y otros parámetros eléctricos en régimen no senoidal.***

**LEARNING ACTIVITIES**

Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints

**CH**

1 h.

**NCH**

4,5 h.

**TH**

5,5 h.

Computer simulation exercises, individually and/or in teams

2 h.

4 h.

9 h.

6 h.

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects

9 h.

9 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**

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. - To calculate the average grade, the minimum grade for each evaluation system must be 3.0, otherwise the lowest grade will be applied.

**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:** 12 h.  
**NCH - Non-class hours:** 8,5 h.  
**TH - Total hours:** 20,5 h.

**CONTENTS**

1. Power computations
  - Sinusoidal and non-sinusoidal waveforms
2. AC-DC converters
  - Single phase rectifiers
  - Three phase rectifiers
3. DC-DC converters

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- Buck, Boost, Buck-Boost, Flyback, Choppers...

4. DC-AC converters

- Single phase inverters
- Half-bridge, full-bridge
- Three phase inverters
- Modulations
- Square-wave, PWM

The contents taught in this subject and the academic activities developed for the acquisition of the defined learning outcomes require students to be aware of the following Sustainable Development Goals of the 2030 Agenda:

**7. Affordable and Clean Energy:** Ensure access to affordable, reliable, sustainable and modern energy for all.

**8. Decent Work and Economic Growth:** Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

**9. Industry, Innovation, and Infrastructure:** Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

## LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Specific Master Software	Hart, Daniel W. Power Electronics. McGraw Hill. New York. 2011. ISMN: 978-007-128930-6
Slides of the subject	Barrado, Andres; Lázaro, Antonio; Problemas de Electrónica de Potencia. Prentice Educación. Madrid, 2007. ISBN: 978-84-205-4652-0