# [GJL201] ELECTRICAL MACHINES

## GENERAL INFORMATION

| | | | | | |
|---|---|---|---|---|---|
| **Studies** | DEGREE IN MECHATRONICS ENGINEERING | | | **Subject** | ? |
| **Semester** | 1 | **Course** | 2 | **Mention / Field of specialisation** | ??? |
| **Character** | OPTIONAL | | | | |
| **Plan** | 2022 | **Modality** | Face-to-face | **Language** | EUSKARA/CASTELLANO |
| **Credits** | 6 | **Hours/week** | 5.11 | **Total hours** | 92 class hours + 58 non-class hours = **150 total hours** |

## 2030 AGENDA GOALS


## PROFESSORS

ALMANDOZ LARRALDE, GAIZKA
ZARATE BARRIGA, SERGIO

## REQUIRED PREVIOUS KNOWLEDGE

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

## LEARNING RESULTS

| LEARNING RESULTS | KC | SK | AB | ECTS |
|---|---|---|---|---|
| **GJR203** - To know and apply the principles of circuit theory and electrical machines | x | | | 5,4 |
| **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 | | 0,36 |
| **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:** | 6 |

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

## SECONDARY LEARNING RESULTS

**RGJ210** **[!]** ***Analiza máquinas de corriente continua y selecciona la máquina apropiada para una aplicación real.***

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | 1 h. | 2,5 h. | 3,5 h. |
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams | 6,25 h. | 3,75 h. | 10 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 4 h. | 1 h. | 5 h. |
| Carrying out exercises and solving problems individually and/or in teams | 9 h. | 5,5 h. | 14,5 h. |
| Practical work in workshops and/or laboratories, individually and/or in teams | 3 h. | 2 h. | 5 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 18% |
| Individual written and/or oral tests or individual coding/programming tests | 74% |
| Prototype / Product | 8% |

**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:** 23,25 h.

**NCH - Non-class hours:** 14,75 h.
**TH - Total hours:** 38 h.

**RGJ211** **[!]** ***Analiza máquinas de corriente alterna. Selecciona el motor y los componentes necesarios para implementar la maniobra eléctrica necesaria para la puesta en marcha de diferentes tipos de máquina.***

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | 2 h. | 6 h. | 8 h. |
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams | 12,5 h. | 7,5 h. | 20 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 2,5 h. | 1 h. | 3,5 h. |
| Carrying out exercises and solving problems individually and/or in teams | 13 h. | 6,5 h. | 19,5 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 8% |
| Individual written and/or oral tests or individual coding/programming tests | 80% |
| Prototype / Product | 12% |

**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:** 30 h.
**NCH - Non-class hours:** 21 h.
**TH - Total hours:** 51 h.

**RGJ209** **[!]** ***Analiza transformadores monofásicos, trifásicos y transformadores de medida.***

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|---|---|---|
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints | 2 h. | 7 h. | 9 h. |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 8 h. | 1 h. | 9 h. |
| Carrying out exercises and solving problems individually and/or in teams | 15,75 h. | 6,25 h. | 22 h. |
| Practical work in workshops and/or laboratories, individually and/or in teams | 3 h. | 3 h. | 6 h. |

| EVALUATION SYSTEM | W |
|---|---|
| Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems | 13% |
| Individual written and/or oral tests or individual coding/programming tests | 87% |

**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

**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:** 28,75 h.
**NCH - Non-class hours:** 17,25 h.
**TH - Total hours:** 46 h.

**1RGJ291** **(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 | 2 h. | 1 h. | 3 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 | 100% | *(No mechanisms)*<br>**Comments:** With the project of the second semester |

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

**1RGJ292** **(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 | 2 h. | 1 h. | 3 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 | 100% | *(No mechanisms)* |

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

**1RGJ293** **(1 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 | 2 h. | 1 h. | 3 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 | 100% | *(No mechanisms)*<br>**Comments:** Revision and correction of the written report of the semester project |

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

**1RGJ290** **(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 | 2 h. | 1 h. | 3 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 | 100% | *(No mechanisms)*<br>**Comments:** With the project of the second semester |

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

**1RGJ294** **(1 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 | 2 h. | 1 h. | 3 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 | 100% | *(No mechanisms)*<br>**Comments:** With the oral presentation of the project of the second semester |

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

## CONTENTS

1. Magnetism2. Transformers2.1. Single-phase transformerThree-phase transformer2.3. Transformer characterization3. Direct current machines3.1. Principle of operation3.2. Types of machines3.3. Characterization3.4. Analysis in steady state4. Synchronous alternator4.1. Principle of operation4.2. Characterization4.3. Analysis in steady state4.4. Alternators connected to the grid4.5. Alternators operating in island mode5. Asynchronous machines5.1. Principle of operation5.2. Types of machines5.3. Characterization5.4. Analysis in steady state

## LEARNING RESOURCES AND BIBLIOGRAPHY

### Learning resources

[!] *Apuntes de la asignatura*
[!] *Laboratorios*
[!] *Plataforma Moodle*
[!] *Presentaciones en clase*

### Bibliography

Fraile Mora, Jesús; Máquinas Eléctricas; UPM; 1993
http://katalogoa.mondragon.edu/janium-bin/janium_login_opac_re_lnk. pl?grupo=MECATRONICA21&ejecuta=30&_ST