

## [GJC202] FOUNDATIONS OF ELECTRICAL ENGINEERING

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN MECHATRONICS ENGINEERING		<b>Subject</b>	?
<b>Semester</b>	1	<b>Course</b>	1	<b>Mention / Field of specialisation</b>
<b>Character</b>	OPTIONAL		<b>Language</b>	CASTELLANO/EUSKARA
<b>Plan</b>	2022	<b>Modality</b>	Face-to-face	<b>Total hours</b>
<b>Credits</b>	6	<b>Hours/week</b>	5	90 class hours + 60 non-class hours = <b>150 total hours</b>

### PROFESSORS

CANALES SEGADE, JOSE MARIA
   
 CABEZUELO ROMERO, DAVID

### REQUIRED PREVIOUS KNOWLEDGE

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

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>G-RA09</b> - To understand and master the basic concepts of the general laws of fields and waves; and electromagnetism and its application to solve engineering problems		x		5,4
<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		0,32
<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		0,28
<b>Total:</b>				<b>6</b>

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

### SECONDARY LEARNING RESULTS

#### **RGJ1114** [!] *Identifica, examina y calcula la oscilación y los fenómenos de onda*

#### 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.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	3 h.	5 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	4 h.	7 h.	11 h.
Practical work in workshops and/or laboratories, individually and/or in teams	2 h.		2 h.

#### EVALUATION SYSTEM

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	90%
Individual written and/or oral tests or individual coding/programming tests	10%

#### MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
   
**Comments:** Correction and redelivery of the document

**CH - Class hours:** 16 h.
   
**NCH - Non-class hours:** 11 h.
   
**TH - Total hours:** 27 h.

#### **RGJ1115** [!] *Resuelve los problemas y las operaciones en el campo del electromagnetismo, relacionando correctamente las magnitudes físicas implicadas*

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		8 h.	7 h.	15 h.
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		2 h.	8 h.	10 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects		14 h.		14 h.
Carrying out exercises and solving problems individually and/or in teams		8 h.	7 h.	15 h.
EVALUATION SYSTEM	W	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	10%	Individual written and/or oral tests or individual coding/programming tests		
Individual written and/or oral tests or individual coding/programming tests	90%	<b>Comments:</b> Final mark for the control points: Written recovery (75%) + Control point (25%). written (75%) + Control point (25%). Practicals and self-assessments will be recovered by means of continuous assessment.		
<b>CH - Class hours:</b> 32 h. <b>NCH - Non-class hours:</b> 22 h. <b>TH - Total hours:</b> 54 h.				

<b>RGJ1116</b> [!] <i>Analiza y resuelve los circuitos de corriente directa y la corriente alterna</i>				
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.	4 h.	8 h.
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		3 h.	6 h.	9 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects		11 h.		11 h.
Carrying out exercises and solving problems individually and/or in teams		9 h.	12 h.	21 h.
Practical work in workshops and/or laboratories, individually and/or in teams		5 h.		5 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	10%	Individual written and/or oral tests or individual coding/programming tests		
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	10%	<b>Comments:</b> Final mark for the control points: Written recovery (75%) + Control point (25%). written (75%) + Control point (25%). Practicals and self-assessments will be recovered by means of continuous assessment.		
Individual written and/or oral tests or individual coding/programming tests	80%			
<b>CH - Class hours:</b> 32 h. <b>NCH - Non-class hours:</b> 22 h. <b>TH - Total hours:</b> 54 h.				

<b>RGJ190</b> [!] <i>Conocer y aplicar las fases para desarrollar de forma guiada, con los objetivos y la planificación previamente definidos, un proyecto de complejidad técnica acorde con los conocimientos de formación básica de la ingeniería. Reflexiona sobre los cono</i>				
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	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)

**Comments:** With the project of the second semester

**CH - Class hours:** 4 h.

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

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

**RGJ191** [!] *Contribuir en la estrategia de funcionamiento del equipo priorizando los objetivos comunes, fomentando y valorando la participación de todas las personas y responsabilizándose de las tareas individuales, así como del cumplimiento de plazos.*

**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**

**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)

**Comments:** With the project of the second semester

**CH - Class hours:** 4 h.

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

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

**RGJ193** [!] *Redacta una memoria de proyecto clara y concisa utilizando las fuentes de información y estructura de memoria facilitadas, 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

1 h.

2 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)

**Comments:** Revision and correction of the written report of the semester project

**CH - Class hours:** 1 h.

**NCH - Non-class hours:** 2 h.

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

**RGJ194** [!] *Realiza una presentación oral y defensa del proyecto clara y concisa, haciendo un uso correcto 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

1 h.

3 h.

4 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)

**Comments:** With the oral presentation of the project of the second semester

**CH - Class hours:** 1 h.  
**NCH - Non-class hours:** 3 h.  
**TH - Total hours:** 4 h.

## CONTENTS

### 1. Electrostatic

Electric charge. Coulomb's Law  
Electric field and flux: Gauss' Law  
Electrostatic energie. Electric potential  
Electrostatic energy storage: Capacitances

### 2. Direct current circuits

Electric circuit and electrical variables: voltage, current  
Resistance. Ohm's Law  
Joule's effect. Electric power  
Simple direct current circuits  
Resolution of complex DC circuits: Kirchhoff's Laws, the theorem of Thévenin, Principal of superposition

### 3. Waves and oscillation phenomena

Sine wave form and its parameters

Harmonics

### 4. Alternating current circuits

AC single-phase mains  
Analysis of simple alternating current circuits in a permanent regime  
Complex impedance. Phasors and vectorial diagrams  
Resolution of alternating current circuits by complex numbers  
Active, reactive and apparent power. Power factor  
Power factor correction

### 5. Electromagnetism

Magnetic field and the electric current: Biot and Savart's law.  
Magnetic flux and flux density  
Magnetic circuits  
Electromagnetic induction: Faradays law  
Magnetic energy storage: Inductance

## LEARNING RESOURCES AND BIBLIOGRAPHY

### Learning resources

Moodle Platform  
Lab practical training  
Class presentations

### Bibliography

F.W. Sears, M.W. Zemansky, H.D. Young, R.A. Freedman. Física Universitaria (2º vol.). 13ª ed. México: Pearson Ed. 2013. ISBN:978-607-322-190-0  
Joseph A. Edminister, Mahmood Nahvi. Circuitos eléctricos. Mc Graw Hill  
P.A. Tipler, G. Mosca. Física para la ciencia y la tecnología (2º vol.). Barcelona:Reverté. 2010. ISBN: 978-84-291-4433-8  
[http://katalogoa.mondragon.edu/janium-bin/janium\\_login\\_opac\\_re\\_in\\_k.pl?grupo=MECATRONICA11&ejecuta=10&\\_ST](http://katalogoa.mondragon.edu/janium-bin/janium_login_opac_re_in_k.pl?grupo=MECATRONICA11&ejecuta=10&_ST)