

[GAI105] ENERGY STORAGE TECHNOLOGY

GENERAL INFORMATION

Studies	DEGREE IN ENERGY ENGINEERING		Subject	ELECTRICAL ENERGY
Semester	1	Course	3	Mention / Field of specialisation
Character	COMPULSORY		Language	ENGLISH
Plan	2017	Modality	Adapted Face-to-face	Total hours
Credits	4,5	Hours/week	2.19	39.5 class hours + 73 non-class hours = 112.5 total hours

PROFESSORS

IRAOLA IRIONDO, UNAI

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
(No specific previous subjects required)	Matlab and Simulink

SKILLS

VERIFICA SKILLS

SPECIFIC

GAES12 - To analyse and implement storage systems for the optimisation of energy efficiency

GENERAL

GACG3 - To take the initiative in problem solving, decision making and creativity, and to communicate and share knowledge and skills, understanding the ethical and professional responsibilities of the business activity in the field of Energy Engineering.

GACG4 - To know how to perform measurements, calculations, valuations, studies, reports, task planning schemes, and other activities pertaining to the field of Energy.

GACG5 - To be able to analyse and assess the social and environmental impact of technical solutions.

GACG8 - To draft and develop energy engineering projects focusing on the design, development and operation of energy applications, systems and services, applying strategies which minimise its impact on the environment.

G_CB6 - To be able to respond adequately in complex situations or situations that call for innovative solutions in both the academic field and work environments within their field of study;

CROSS

GACTR2 - To be able to do their job in cooperative, participatory environments, with awareness of social responsibility.

BASIC

G_CB3 - To be capable of gathering and interpreting relevant data (normally within their field of study) in order to make judgements, reflecting on relevant matters of a social, scientific or ethical nature

LEARNING RESULTS

RG301 Assumes responsibilities in the work team, organizing and planning the tasks to be developed, facing the contingencies and encouraging the participation of its members.

LEARNING ACTIVITIES

Development, writing and presentation of memorandums, reports, audiovisual material, etc.
Relating to projects/POPBLs carried out individually or in teams

CH

NCH

TH

5 h.

5 h.

EVALUATION SYSTEM

W

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence

Comments: Assesment of the acquired transversal skills:

Followed methodology to solve the project: team work, decision making methods, conflict management... Project management: Definition of objectives, planning,... Written communication Oral communication

100%

MAKE-UP MECHANISMS

(No mechanisms)

Comments: Continuous assesment. The project is managed through the tutoring meetings and the meetings held with the experts, errors are corrected and the precise guidelines are given to overcome the project.

CH - Class hours: 0 h.

NCH - Non-class hours: 5 h.

TH - Total hours: 5 h.

RG302 Analyze the intervening variables in the problem and propose actions for a stable situation.

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams			5 h.	5 h.
EVALUATION SYSTEM	<i>W</i>	MAKE-UP MECHANISMS		
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	100%	<i>(No mechanisms)</i>		
Comments: Assesment of the acquired transversal skills: Followed methodology to solve the project: team work, decision making methods, conflict management... Project management: Definition of objectives, planning,... Written communication Oral communication		Comments: Continuous assesment. The project is managed through the tutoring meetings and the meetings held with the experts, errors are corrected and the precise guidelines are given to overcome the project.		
CH - Class hours: 0 h. NCH - Non-class hours: 5 h. TH - Total hours: 5 h.				

RG304 Define the problem, develop the solution and present the conclusions in a efficient manner, arguing and justifying each one of them in writing.

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams			4 h.	4 h.
EVALUATION SYSTEM	<i>W</i>	MAKE-UP MECHANISMS		
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	100%	<i>(No mechanisms)</i>		
Comments: Assesment of the acquired transversal skills: Followed methodology to solve the project: team work, decision making methods, conflict management... Project management: Definition of objectives, planning,... Written communication Oral communication		Comments: Continuous assesment. The project is managed through the tutoring meetings and the meetings held with the experts, errors are corrected and the precise guidelines are given to overcome the project.		
CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h.				

RG305 Define the problem, develop the solution and present the conclusions in a efficient manner, arguing and justifying each one of them in spoken form.

LEARNING ACTIVITIES		<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams			4 h.	4 h.
EVALUATION SYSTEM	<i>W</i>	MAKE-UP MECHANISMS		
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	100%	<i>(No mechanisms)</i>		
Comments: Assesment of the acquired transversal skills: Followed methodology to solve the project: team work, decision making methods, conflict management... Project management: Definition of objectives, planning,... Written communication Oral communication		Comments: Continuous assesment. The project is managed through the tutoring meetings and the meetings held with the experts, errors are corrected and the precise guidelines are given to overcome the project.		
CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h.				

RGA319 To analyze energy storage systems.

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams		3 h.	3 h.
Individual study and work, tests and evaluations and check points	2 h.	4 h.	6 h.
Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	12 h.		12 h.
Individual and team exercises		5 h.	5 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Individual written and oral tests to assess technical skills of the subject	90%	Individual written and oral tests to assess technical skills of the subject
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	10%	

Comments: Continuous assesment of the projects. For that the following will be taken into account: (a) Continuous assesment about the fulfillment of the tasks during the development of the project, both individual and teamwork; (b) In the end of the project, the solution proposed by the students team, as well as the corresponding report; (c) Finally, the oral defense of the project, addressing the acquired knowledge, the quality of the presentation as well as the reasoned justification of the principles and causes of proposing the selected solution.

CH - Class hours: 14 h.
NCH - Non-class hours: 12 h.
TH - Total hours: 26 h.

RGA320 To choose and size energy storage systems depending on the application and reaching the maximum efficiency for the system.

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams		30 h.	30 h.
Individual study and work, tests and evaluations and check points	2,5 h.	4 h.	6,5 h.
Practices of problem solving and real or simulated context projects	3 h.	9 h.	12 h.
Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Individual written and oral tests to assess technical skills of the subject	60%	Individual written and oral tests to assess technical skills of the subject
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	40%	

Comments: Continuous assesment of the projects. For that the following will be taken into account: (a) Continuous assesment about the fulfillment of the tasks during the development of the project, both individual and teamwork; (b) In the end of the project, the solution proposed by the students team, as well as the corresponding report; (c) Finally, the oral defense of the project, addressing the acquired knowledge, the quality of the presentation as well as the reasoned justification of the principles and causes of proposing the selected solution.

CH - Class hours: 25,5 h.
NCH - Non-class hours: 43 h.
TH - Total hours: 68,5 h.

CONTENTS

THEORETICAL ASPECTS

Energy storage systems types:

- Mechanical
- Electrochemical
- Thermal
- Electrostatic and electromagnetic
- Hydrogen technologies

LAB WORK

1.- It consists of the analysis of two energy storage systems, in this case electrochemical ones, concretely lithium ion and lead acid technologies, during charge and discharge processes.

2.- Lithium ion batteries behavioural modelling.

EXERCISES

Exercises will be related to the sizing of batteries and supercapacitors.

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Subject notes
Technical articles
Video projections
Moodle Platform
Class presentations
Lab practical training

Bibliography

http://katalogoa.mondragon.edu/janium-bin/janium_login_opac_re_in_k.pl?grupo=ENERGIA31&ejecuta=20