[MSC101] STORAGE SYSTEM

GENERAL INFORMATION

Studies	MASTER DEGREE IN SMART ENERGY SYSTEMS			**Subject**	?
Semester	1	**Course**	1	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2025	**Modality**	Face-to-face	**Language**	EUSKARA/CASTELLANO
Credits	4,5	**Hours/week**	0	**Total hours**	63 class hours + 49.5 non-class hours = **112.5 total hours**

2030 AGENDA GOALS

PROFESSORS

IRAOLA IRIONDO, UNAI
LOPETEGUI TAPIA, IKER

REQUIRED PREVIOUS KNOWLEDGE

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

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
MS081 - Modelling, sizing, implementing and testing storage systems for electromobility and renewable energy applications		x		4,02
MS171 - Ability to work in multidisciplinary teams and in a multilingual environment	x		x	0,12
MS222 - Exhibits, argues and defends the results obtained in the work carried out before a panel of judges			x	0,12
MS251 - Develops a project in the field of energy systems in a practical application context		x		0,24
			Total:	4,5

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

SECONDARY LEARNING RESULTS

RMS114 **[!]** ***Modelar, dimensionar, implementar y testear sistemas de almacenamiento para aplicaciones de electromovilidad y energías renovables***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	3 h.		3 h.
Computer simulation exercises, individually and/or in teams	15 h.	20,5 h.	35,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	30 h.		30 h.
Carrying out exercises and solving problems individually and/or in teams	12 h.	20 h.	32 h.

EVALUATION SYSTEM	W
Individual written and/or oral tests or individual coding/programming tests	100%

MAKE-UP MECHANISMS

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

CH - Class hours: 60 h.
NCH - Non-class hours: 40,5 h.
TH - Total hours: 100,5 h.

RMS222 **[!]** ***Expone, argumenta y defiende ante un tribunal los resultados obtenidos en el trabajo desarrollado***

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	3 h.		3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Individual written and/or oral tests or individual coding/programming tests	100%	Individual written and/or oral tests or individual coding/programming tests

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

RMS251 **[!]** ***Desarrolla un proyecto del ámbito de los sistemas energéticos en un contexto de aplicación práctica***

LEARNING ACTIVITIES	CH	NCH	TH
Practical work in workshops and/or laboratories, individually and/or in teams		6 h.	6 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Prototype / Product	100%	Prototype / Product

CH - Class hours: 0 h.
NCH - Non-class hours: 6 h.
TH - Total hours: 6 h.

RMS171 **[!]** ***Es capaz de trabajar en equipos multidisciplinares y en un entorno multilingüe***

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		3 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Prototype / Product	100%	Prototype / Product

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

CONTENTS

The subject is divided into the following blocks:**1.- Introduction to storage systems:**
Basic concepts of energy storage in lead and lithium batteries. Furthermore, this block defines the different hardware components that go into a real battery, from the cells, protections and sensors, all the way to the BMS. From here, in this subject we will focus on lithium-ion batteries.
2.- Modeling of lithium ion batteries:
3 types of lithium ion cell models are proposed, ECMs, ECMs half cell and physical models or PBMs. After the class explanation, a CW1 will be carried out on modeling systems in which these models will have to be implemented and conclusions obtained in this regard.**3.- State algorithm in lithium batteries**: In this block we will analyze what the state estimators of a battery are, specifically, the SOC, SOH and the SOP. For this purpose, in class we will also talk in this block about aging of lithium batteries, to link these concepts with the problems that arise when estimating the hidden states of the battery. In this block, CW2 and CW3 will be carried out to estimate the SOC and SOH.**4.- Battery sizing:**
In this last block we will analyze the problems associated with battery sizing.

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Subject notes	Acceso online a bibliografía: https://labur.eus/2lQuI
Labs	
Moodle Platform	