[MSA001] Modelling and simulation of energy systems

GENERAL INFORMATION

Studies	MASTER DEGREE IN SMART ENERGY SYSTEMS			**Subject**	Modelling and Simulation of energy systems
Semester	1	**Course**	1	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2022	**Modality**	Face-to-face	**Language**	CASTELLANO
Credits	4,5	**Hours/week**	0	**Total hours**	63 class hours + 49.5 non-class hours = **112.5 total hours**

PROFESSORS

MAZUELA LARRAÑAGA, MIKEL

IBISATE ALDAY, JON

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
Electric power conversion	*(No previous knowledge required)*
Electrotechnics	
Modelling, simulation and control of multi-phisical systems	

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
MSR021 - Analyse and model power converters and electrical machines for energy systems.	*x*	*x*		2
MSR022 - Design and evaluate control structures for converters and electrical machines	*x*	*x*		2
MSR171 - Ability to work in multidisciplinary teams and in a multilingual environment	*x*		*x*	0,16
MSR222 - Exhibits, argues and defends the results obtained in the work carried out before a panel of judges			*x*	0,1
MSR251 - 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

RMS103 **[!]** ***Analizar y modelar convertidores de potencia y máquinas eléctricas para sistemas energéticos.***

LEARNING ACTIVITIES	CH	NCH	TH
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		6 h.	6 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.		2 h.
Computer simulation exercises, individually and/or in teams	14 h.	6 h.	20 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	8 h.		8 h.
Carrying out exercises and solving problems individually and/or in teams	7,5 h.	6,5 h.	14 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%
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	33%
Individual written and/or oral tests or individual coding/programming tests	17%

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: The final mark of the written exam will be the same of the retake exam. The retaken deliverables will have a maximum mark of 5.

CH - Class hours: 31,5 h.
NCH - Non-class hours: 18,5 h.
TH - Total hours: 50 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		2,5 h.	2,5 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	100%	*(No mechanisms)*

CH - Class hours: 0 h.
NCH - Non-class hours: 2,5 h.
TH - Total hours: 2,5 h.

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

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		6 h.	6 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: 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
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.

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: 0 h.
NCH - Non-class hours: 4 h.
TH - Total hours: 4 h.

RMS104 **[!]** ***Diseñar y evalúar estructuras de control para convertidores y máquinas eléctricas***

LEARNING ACTIVITIES	CH	NCH	TH
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		6 h.	6 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing	2 h.		2 h.

checkpoints			
Computer simulation exercises, individually and/or in teams	10 h.	6 h.	16 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	12 h.		12 h.
Carrying out exercises and solving problems individually and/or in teams	7,5 h.	6,5 h.	14 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	47%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
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	33%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	20%	

CH - Class hours: 31,5 h.
NCH - Non-class hours: 18,5 h.
TH - Total hours: 50 h.

CONTENTS

1. Converter modelling

1.0. Modelling and converter types

1.1. Semiconductor's characterization

1.2. Analytic model of the converter

1.3. Dynamic model of the converter (*Equation based*)

1.3.1. Ideal Load

1.3.2. Real Load

1.3.3. Thermal Model

1.4. Averaged dynamic model of the converter (*Low Fidelity*)

2. Electric machine modelling

2.0 Introduction to electric machines

2.1 Space vector theory revision

2.2. Modeling of induction motors

3. Electric machine control

4. Grid connected converters control

5.Modeling and control of a PMSM (challenge)

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Subject notes	https://labur.eus/HgcNq
Labs	
Moodle Platform	
Lab practical training	
Specific Master Software	
Class presentations	
Programmes	