Goi Eskola Politeknikoa | Mondragon Unibertsitatea
Course: 2024 / 2025 - Course planning

Mondragon Unibertsitatea / Goi Eskola Politeknikoa / Escuela Politécnica Superior

[MSA003] Digital twins for Energy Systems

GENERAL INFORMATION

Studies	MASTER DEGREE IN SMART ENERGY SYSTEMS	**Subject**	Modelling and Simulation of energy systems
Semester	1	**Course** 1	
Character	COMPULSORY	**Mention / Field of specialisation**	
Plan	2022	**Modality** Face-to-face	**Language** ENGLISH
Credits	4,5	**Hours/week** 0	**Total hours** 68 class hours + 44.5 non-class hours = **112.5 total hours**

PROFESSORS

DEL OLMO LARRAÑAGA, JON

ARRUTI ROMERO, ASIER

REQUIRED PREVIOUS KNOWLEDGE

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

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
MSR011 - Analyse, model and simulate the dynamic behaviour of multivariable energy systems for the implementation of digital twins.	x	x		2,48
MSR012 - Using data pre-processing tools in the field of energy	x		x	1,54
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	0,08
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

RMS102 [!] *Utilizar herramientas de preprocesado de datos en el ámbito de la energía*

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.	9 h.	17 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	1 h.	3 h.
Computer simulation exercises, individually and/or in teams	8 h.	4,5 h.	12,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	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	17%	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	50%	

CH - Class hours: 24 h.
NCH - Non-class hours: 14,5 h.
TH - Total hours: 38,5 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		2 h.	2 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: 2 h.
TH - Total hours: 2 h.

RMS101 [!] *Analizar, modelar y simular el comportamiento dinámico de sistemas energéticos multivariables para la implementación de gemelos digitales*

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.	6 h.	14 h.
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		8 h.	8 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	5 h.		5 h.
Computer simulation exercises, individually and/or in teams	8 h.	4 h.	12 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	14 h.		14 h.
Practical work in workshops and/or laboratories, individually and/or in teams	9 h.		9 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	17%	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	50%	

CH - Class hours: 44 h.
NCH - Non-class hours: 18 h.
TH - Total hours: 62 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.

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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.

CONTENTS

Introduction to digital twins

Definition and evolution of digital twins
Digital twin components: models and data

Physics-based dynamic models

Electric systems
Electronic systems
Mechanical systems

Data processing tools

EDA introduction

Data visualization

Measures of centrality, dispersion, skewne

Coursework: Digital twin of electric scooter

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Class presentations	Acceso online a bibliografía: https://labur.eus/EjP7v
Moodle Platform	