

Course: 2022 / 2023 - Course planning

Unibertsit atea Goi Eskola Politeknikoz Escuela Politécnica Superior

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[GJK105] MODELLING AND SIMULATION OF DYNAMIC SYSTEMS

		G	ENERAL INF	ORMATION
Studies	DEGREE IN ME	CHATRONICS ENG	GINEERING	Subj
Semester	1	Course	3	Mention / Field
haracter	COMPULSORY			specialisat
Plan	2020	Modality	Adapted Face-to-face	Langua
Credits	4,5	Hours/week	3.75	Total ho

Subject ? Mention / Field of specialisation

Language ENGLISH

Total hours 67.5 class hours + 45 non-class hours = 112.5 total hours

Knowledge

(No previous knowledge required)

PROFESSORS

ALACANO LOITI, ARGIÑE ARANGUREN DERIOZPIDE, JON

REQUIRED PREVIOUS KNOWLEDGE

PHYSICS I

FOUNDATIONS OF ELECTRICAL ENGINEERING MATHEMATICS APPLIED TO ENGINEERING

Subjects

SKILLS

VERIFICA SKILLS

SPECIFIC

GJCE07 - Knowledge and capacity for modelling and simulation of dynamic systems.

GENERAL

GJCG01 - To be able to take the initiative in problem solving, decision making, creativity, critical thinking, effective communication and the transfer of knowledge and skills in the field of mechatronics engineering

GJCG05 - Developing and designing products, equipment and mechatronic systems while complying with the technical, economic, quality and safety requirements established in the specifications and required by current legislation

BASIC

G_CB1 - To have proven to understand and have knowledge in a field of study based on general secondary education at a level found in advanced textbooks and including concepts at the forefront of their field of study.

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 They assume responsibilities in the team, organizing and planning the tasks to be developed, dealing with contingencies and encouraging the participation of its members.

Development, writing and presentation of memorandums, re Relating to projects/POPBLs carried out individually or in te	eports, a ams	udiovisual material, etc.	2 h.	1 h.	3 h.
EVALUATION SYSTEM	w	MAKE-UP MECHANIS	MS		
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence		Technical skills, involve results, handed docum defence	al skills, involvement in the project, finished work, obt handed documentation, presentation and technical		
		Comments: With the project of the second semester			ester
CH - Class hours: 2 h. ICH - Non-class hours: 1 h.					

RC302 They analyze the variables involved in the problem and propose actions for a stable situation.

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LEARNING ACTIVITIES	CH	NCH	ТН
Development, writing and presentation of memorandums, reports, audiovisual material, etc.	2 h.	1 h.	3 h.
Relating to projects/POPBLs carried out individually or in teams			



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EVALUATION SYSTEM	W	MAKE-UP MECHANIS	SMS		
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence		Technical skills, involvement in the project, finishe results, handed documentation, presentation and defence			ed work, obtainec I technical
		Comments: with the p	project of the	e second seme	ster
CH - Class hours: 2 h. NCH - Non-class hours: 1 h. TH - Total hours: 3 h					
RG304 They define the problem, the development of th justifying each of them, making a correct use of the lang	e solutio uage, in	on, as well as the conclu writing.	isions in ar	effective way	y, arguing and
LEARNING ACTIVITIES			СН	NCH	тн
Development, writing and presentation of memorandums, re	eports, a	udiovisual material, etc.	1 h.	2 h.	3 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANIS	SMS		
Technical skills, involvement in the project, finished work,	100%	Technical skills, involve	ement in the	project, finish	ed work, obtained
obtained results, handed documentation, presentation and technical defence		results, handed documentation, presentation and technical defence			
		Comments: Revision a	and correction	on of the writte	n report of the
CH - Class hours: 1 h. NCH - Non-class hours: 2 h.					
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RG305 They define the problem, the development of th	e solutio	on, as well as the conclu	isions in ar	effective way	y, arguing and
RG305 They define the problem, the development of th justifying each one of them, and making a correct use of	e solutio	on, as well as the conclu guage, orally.	isions in ar	effective way	y, arguing and
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Individual written and oral tests to assess technical skills of $^{100\%}$ the subject

Individual written and oral tests to assess technical skills of the subject

CH - Class hours: 25 h. NCH - Non-class hours: 12,5 h. TH - Total hours: 37,5 h.

RGJ3302 They simulate the dynamic behaviour of simp	le multi	physical systems			
LEARNING ACTIVITIES			СН	NCH	тн
Development, writing and presentation of memorandums, re Relating to projects/POPBLs carried out individually or in te	eports, a ams	udiovisual material, etc.	10 h.	6 h.	16 h.
Practices of problem solving and real or simulated context projects				7 h.	17 h.
Presentation of the teacher in the classroom, in participator	y classe	s, of concepts and	16,5 h.	13,5 h.	30 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANIS	MS		
Individual written and oral tests to assess technical skills of the subject	60%	Individual written and oral tests to assess technical skills of subject		al skills of the	
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	40%				

CONTENTS

- 1.- Introduction to Dynamic Systems and Control
- 1.1 Introduction
- 1.2 Classification of Dynamic Systems
- 1.3 Modeling Dynamic Systems

CH - Class hours: 36,5 h. NCH - Non-class hours: 26,5 h. TH - Total hours: 63 h.

- 1.4 Objectives and Course Outline
- 2.- Modeling Mechanical Systems
- 2.1 Introduction
- 2.2 Mechanical Element Laws
- 2.3 Translational Mechanical Systems
- 2.4 Rotational Mechanical Systems
- 3.- Modeling Electrical and Electromechanical Systems
- 3.1 Introduction
- 3.2 Electrical Element Laws
- 3.3 Electrical Systems
- 3.4 Electromechanical Systems
- 4.- Standard Models for Dynamic Systems
- 4.1 Introduction
- 4.2 Input-Output Equations
- 4.3 Transfer Functions



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4.4 Block Diagrams

- 4.5 Standard Input Functions
- 5.- Numerical Simulation of Dynamic Systems
- 5.1 Introduction
- 5.2 System Response Using MATLAB Commands
- 5.3 Building Simulations Using Simulink
- 5.4 Simulating Linear Systems Using Simulink
- 6.- Analytical Solution of Dynamic Systems
- 6.1 Introduction
- 6.2 Analytical Solutions to Linear Differential Equations
- 6.3 First-Order System Response
- 6.4 Second-Order System Response
- 7.- System Analysis Using Laplace Transforms
- 7.1 Introduction
- 7.2 Laplace Transformation
- 7.3 Inverse Laplace Transformation
- 7.4 Analysis of Dynamic Systems Using Laplace Transforms

LEARNING RESOURCES AND BIBLIOGRAPHY				
Learning resources	Bibliography			
Moodle Platform	Craig A. Kluever, Dynamic systems: Modeling, Simulation			
Programmes	andControl, 1st edition (2015), ISBN: 978-1-118-28945-7			
Slides of the subject	http://katalogoa.mondragon.edu/janium-bin/janium_login_opac_re_ln k.pl?grupo=MECATRONICA31&ejecuta=15&_ST			