

[MRA108] LINEAR AND NON-LINEAR CONTROL

GENERAL INFORMATION

Studies	Master's Degree in ROBOTICS AND CONTROL SYSTEMS		Subject	?
Semester	1	Course	1	Mention / Field of specialisation
Character	COMPULSORY		Language	CASTELLANO/EUSKARA
Plan	2023	Modality	Face-to-face	Total hours
Credits	5	Hours/week	0	51 class hours + 74 non-class hours = 125 total hours

PROFESSORS

ECIOLAZA ECHEVERRIA, LUKA

 POGGI, TOMASO

REQUIRED PREVIOUS KNOWLEDGE

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

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
M1R207 - [!] <i>Diseñar y simular estrategias de retroalimentación (feedback) para el control de sistemas dinámicos lineales y no-lineales</i>		x		3,2
M1R223 - [!] <i>Capacidad de trabajar en equipos multidisciplinares y en un entorno multilingüe y de comunicar, tanto de forma oral como escrita, conocimientos, procedimientos, resultados e ideas relacionadas con los temas afines al máster</i>		x		0,8
M1R224 - [!] <i>Capacidad para ejercer su profesión con actitud cooperativa y participativa, y con responsabilidad social</i>		x		0,2
M1R225 - [!] <i>Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.</i>		x		0,4
M1R226 - <i>To apply the knowledge acquired and your problem-solving skills in new, little-known or changing environments within broader (or multidisciplinary) contexts related to your area of study</i>		x		0,4
Total:				5

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

SECONDARY LEARNING RESULTS

RA190 [!] *Evalua y diseña sistemas de control para procesos industriales y sistemas autonomos, y, trabajando individualmente y en equipos multidisciplinares cooperando para obtener la trabajando individualmente y en equipos multidisciplinares cooperando para*

LEARNING ACTIVITIES

	CH	NCH	TH
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	15 h.	30 h.	45 h.
Carrying out exercises and solving problems individually and/or in teams	10 h.	8 h.	18 h.

EVALUATION SYSTEM

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

W

100%

MAKE-UP MECHANISMS

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

Comments: All activities (control points, individual and group work, etc.) must have a minimum grade of 5 and an opportunity for recovery (except the PBL). In unapproved training activities (less than 5) the recovery is compulsory and the final grade will be the grade obtained in the recovery. In the activities carried out it is necessary to obtain a minimum mark of 4 to calculate the average mark of the learning result. Otherwise, the note of the learning result will be that of the suspended activity. The system will calculate the final grade with the RA, applying the percentages defined in IKOF.

CH - Class hours: 25 h.

NCH - Non-class hours: 38 h.

TH - Total hours: 63 h.

RA191 [!] *Implementa y valida de control para procesos industriales y sistemas autonomos, y, trabajando individualmente y en*

equipos multidisciplinares y asegurando su capacidad para adaptarse a situaciones donde se requieran nuevos conocimientos que se han de

LEARNING ACTIVITIES

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
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.	8 h.	12 h.
Practical work in workshops and/or laboratories, individually and/or in teams	22 h.	28 h.	50 h.

EVALUATION SYSTEM

W

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

100%

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

Comments: All activities (control points, individual and group work, etc.) must have a minimum grade of 5 and an opportunity for recovery (except the PBL). In unapproved training activities (less than 5) the recovery is compulsory and the final grade will be the grade obtained in the recovery. In the activities carried out it is necessary to obtain a minimum mark of 4 to calculate the average mark of the learning result. Otherwise, the note of the learning result will be that of the suspended activity. The system will calculate the final grade with the RA, applying the percentages defined in IKOF.

CH - Class hours: 26 h.
NCH - Non-class hours: 36 h.
TH - Total hours: 62 h.

CONTENTS

1. Linear algebra recalls
2. Linear and nonlinear dynamical Systems
3. Laplace Transform and Transfer Functions
4. Controllability and Pole-placement
5. Observability and state estimation
6. Output feedback and integral action
7. Lyapunov functions and global stability
8. Nonlinear control design
9. Fuzzy Logic and Fuzzy Control Systems

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Subject notes
 Moodle Platform
 Slides of the subject
 Computer practical training

Bibliography

K.J. Åström, R.M. Murray, “Feedback Systems: An Introduction for Scientists and Engineers”
 S.L. Brunton, J.N. Kutz, “Data-Driven Science & Engineering”, Prentice-Hall
 J.J. Slotine, W. Li, “Applied Nonlinear Control”, Prentice-Hall
 S. Strogatz, “Nonlinear Dynamics and Chaos”
 H. Khalil, “Nonlinear systems”, Prentice-Hall

A. Isidori, “Nonlinear Control Systems”, Springer
E. Trillas, L. Eciolaza, “Fuzzy Logic”, Springer
S.L. Brunton - “Control Bootcamp” (On-line lessons
on YouTube)