Course guide
240625 - 240625 - Linear Control Systems: Internal Description

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: **Academic year:** 2023 **ECTS Credits:** 4.5
Languages: English

LECTURER

Coordinating lecturer: Marta Peña

Others: Ferrer Llop, Jose

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
3. Capacity to design control systems and industrial automation.

Transversal:
1. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

There will be theoretical and practical classes

LEARNING OBJECTIVES OF THE SUBJECT

The subject provides an overview of the theory of linear systems as a qualitative study of mathematical models of physical systems. In particular the properties of stability, controllability and observability, and the ability to change some of these properties through appropiate feedback.

STUDY LOAD

Type	Hours	Percentage
Self study	67,5	60.00
Hours medium group	45,0	40.00

Total learning time: 112.5 h

CONTENTS

(ENG) 1: Characterization of systems

Description:
Dynamical systems. Equilibrium and linearization. Continuous linear systems. Composition of systems.

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Full-or-part-time: 35h
Theory classes: 5h
Practical classes: 5h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

(ENG) 2: Controlabillity and observability

Description:
Controllable systems. Observable systems. Uncontrollable systems: controllable subsystem. Unobservable systems: observable subsystem. Kalman decomposition.

Related activities:
Continued mark 1

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
CETI11B. Capacity to design control systems and industrial automation.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Full-or-part-time: 52h 30m
Theory classes: 7h 30m
Practical classes: 7h 30m
Theory classes: 7h 30m
Practical classes: 7h 30m
Self study : 22h 30m

(ENG) 3: Design

Description:
Pole assignment by state feedback. Observers.

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
CETI11B. Capacity to design control systems and industrial automation.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Full-or-part-time: 35h
Theory classes: 5h
Practical classes: 5h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

(ENG) 4: Realization

Description:
Canonical controllable realization. Canonical observable realization. MacMillan degree. Minimal realization.

Related activities:
Continued mark 2

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.
CETI11B. Capacity to design control systems and industrial automation.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Full-or-part-time: 35h
Theory classes: 5h
Practical classes: 5h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

ACTIVITIES

(ENG) AVALUACIO CONTINUADA 1

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

Full-or-part-time: 2h
Self study: 2h

(ENG) AVALUACIO CONTINUADA 2

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

Full-or-part-time: 2h
Self study: 2h

GRADING SYSTEM

Final Mark=0.6*FinalExam+0.2*ContinuedMark1+0.2*ContinuedMark2

BIBLIOGRAPHY

Basic:
- Wonham, W. M. Linear Multivariable Control [on line]. 3rd ed. New York: Springer Verlag, 1985 [Consultation: 24/04/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6568808. ISBN 9781461270058.
- Kongoli, Florian. Automation [on line]. 2012. Rijeka, Croatia: In Tech, 2012 [Consultation: 18/04/2023]. Available on: http://www.intechopen.com/books/automation. ISBN 9789535106852.
- Chen, Chi-Tsong. Introduction to linear system theory. New York: Holt, Rinehart and Winston, cop. 1970. ISBN 030771552.