Course guide
340033 - FOAU-F4O07 - Fundamentals of Automatic Control

Last modified: 19/06/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: FRANCISCO JAVIER RUIZ VEGAS

Others: FRANCISCO JAVIER RUIZ VEGAS
XAVIER LLANAS PARRA
RAMON GUZMAN SOLA
Lumbiarres López, Rubén

PRIOR SKILLS

Prerequisites: basic Calculus and Algebra course, with complex numbers and a basic cours on Physics.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
3. CE12. Knowledge of fundamental automatism and control methods.

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

TEACHING METHODOLOGY

theoretical classes, practical classes and laboratory

LEARNING OBJECTIVES OF THE SUBJECT

1. To understand the concept of linear dynamic system invariant in time and its representation through its transfer function.
2. To be able to model some mechanical and electrical systems using the formalism of the transfer functions.
3. To determine the characteristics that may hold the responses to first and second order systems where standard inputs (impulse, step or ramp) are applied.
4. To understand the advantages of closed loop system.
5. To be able to represent by Bode and Nyquist diagrams frequency responses of first and second order systems, as well as higher order systems.
6. To know how to interpret frequency diagrams.
7. To learn to select in some cases the best controller to reach the given specifications relating to stability, steady-state error and characteristics of the stationary response.
8. To Be able to simulate the behavior of linear systems using MATLAB and Simulink.

STUDY LOAD

Type	Hours	Percentage
Hours large group	22,5	15.00
Self study	90,0	60.00
Hours small group	37,5	25.00

Total learning time: 150 h

CONTENTS

Unit 0: Automation and Robotics fundamentals

Full-or-part-time: 22h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 12h
Guided activities: 3h
Self study : 3h

Unit 1: Transfer Functions

Full-or-part-time: 17h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study : 12h

Unit 2: Physical systems modeling

Full-or-part-time: 17h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study : 12h

Unit 3: Time response analysis

Full-or-part-time: 17h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study : 12h

Unit 4: Properties of feedback systems

Full-or-part-time: 17h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study : 12h

Unit 5: Frequency response analysis

Full-or-part-time: 20h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 4h
Self study : 12h

Unit 6: Stability analysis using frequency response

Full-or-part-time: 20h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 4h
Self study : 12h

Unit 7: Control systems dessign

Full-or-part-time: 20h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 4h
Self study : 12h

GRADING SYSTEM

Midterm: P Control lab practice 1 2 and 3: L1 MATLAB control: L2 Control lab practice 5 and 6: L3 Oral exposition: O Final Exam: F
Laboratori grade: L=0.33L1+0.33L2+0.33L3
Theory and problems grade: T=max(F, 0.5·P+0.5·F)
Final grade: max(0.7·T+0.3·L, 0.65·T+0.25·L+0.1·O)
If Final grade is between 2.0 and 4.9, students can take a Retake exam that substitute Theory and problems grade. However the maximum grade for students who takes the retake exam will be 7.

BIBLIOGRAPHY

Basic:
- Villà Millaruelo, Ricard. Dinàmica de sistemes. Barcelona: Serveis Gràfics Copisteria Imatge, 2012.
- Ogata, Katsuhiko. Ingeniería de control moderna [on line]. 5a ed. Madrid [etc.]: Pearson Prentice Hall, 2010 [Consultation: 16/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259. ISBN 9788483226605.
- Kuo, Benjamin C.. Sistemas de control automático. México: Prentice Hall Hispanoamericana, 1996. ISBN 9688807230.