COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

Syllabus
2022 - 2023

GENERAL INFORMATION

Data of the subject	
Subject name	Control Systems
Subject code	DEA-GITI-321
Mainprogram	Bachelor's Degree in Engineering for Industrial Technologies
Involved programs	Grado en Ingeniería en Tecnologías Industriales y Grado en Administración y Dirección de Empresas [Third year] Grado en Ingeniería en Tecnologías Industriales y Grado en Administración y Dirección de Empresas [Third year] Grado en Ingeniería en Tecnologías Industriales [Third year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	6,0 ECTS
Type	Compulsory
Department	Department of Electronics, Control and Communications
Coordinator	Ramón Rodríguez Pecharromán
Schedule	See web
Office hours	Send e-mail to get an appointment
Course overview	Introduction to feedback control systems. Stability, accuracy, speed and damping. Design of PID control systems.

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DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites

Basic knowledge of Dynamic Systems is required. Analysis of LTI systems in both time and frequency domains.

Course contents

Contents
CONTROL SYSTEMS ANALYSIS AND DESIGN BASED ON THE TIME RESPONSE
1. INTRODUCTION TO CONTROL SYSTEMS
1.1 Concept of control system. **1.2** Control system objectives. **1.3** Structure and components of a control system. **1.4** Specifications and control methods.
2. SECOND-ORDER CONTROL SYSTEMS DESIGN
2.1 Damping, speed and accuracy. **2.2** Additional poles and zeros.
3. STEADY-STATE ACCURACY
3.1 Setpoint tracking. **3.2** Disturbance rejection. **3.3** Typical configurations for accuracy analysis. **3.4** Feed-forward.
CONTROL SYSTEMS ANALYSIS AND DESIGN BASED ON THE FREQUENCY RESPONSE
4. STABILITY
4.1 Nyquist and Black diagrams. **4.2** Nyquist stability criterion. **4.3** Reverse stability criterion. **4.4** Routh-Hurwitz stability criterion.
5. CONTROL DESIGN BASED ON FREQUENCY RESPONSE
5.1 Relationship between time and frequency responses. **5.2** Stability margins. **5.3** P Control. **5.4** PI Control.

5.5 PD Control.

5.6 PID Control.

COMPUTER-CONTROLLED SYSTEMS AND COMPLEMENTARY ISSUES

6. INTRODUCTION TO COMPUTER-CONTROLLED SYSTEMS

6.1 Automiatic systems.

6.2 Effect of the sampling time.

6.3 Control algorithms.

7. COMPLEMENTARY ISSUES

7.1 Integral saturation.

7.2 Setpoint weighting.

7.3 Root locus.

LABORATORY

LAB PROJECTS

Project 1

Design and analysis of a PID control system based on second-order systems time response and pole-zero location.

Process model estimation.

Project 2

Design and analysis of a PID control system based on the process frequency response.

Process model estimation.

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Mid-term and final exams (individual)	• Understanding concepts. • Problem solving. • Problem-solving results assesment. • Writing.	65 %
Continuous evaluation quizzes (individual)	• Understanding concepts. • Problem solving. • Problem-solving results assesment.	10 %

Lab sessions (group)	• Understanding concepts. • Lab sessions performance. • Lab sessions results assesment. • Teamworking skill. • Writing	25 %

Grading

In the ordinary period grading is composed of:

- Final exam: 45%. A minimum grade of 5 is required on the final exam to pass the course.
- Mid-term exam: 20%.
- Continuous evaluation quizzes: 10%
- Lab: 25%. A minimum grade of 5 is required to pass the course.

In case of failing, the re-take exam may include both theory and lab contents.

ORDINARY

In the ordinary period the grading is composed of:

- Final exam: 45%. A minimum grade of 5 is required on the final exam to pass the course.
- Mid-term exam: 20%.
- Continuous evaluation quizzes: 10%
- Lab: 25%. A minimum grade of 5 is required to pass the course.

EXTRAORDINARY (RE-TAKE) EXAM

In the re-take exam grading is composed of:

- Re-take exam: 55%. A minimum grade of 5 is required on the final exam to pass the course.
- Mid-term exam: 15%.
- Continuous evaluation quizzes: 5%
- Lab: 25%. A minimum grade of 5 is required to pass the course.

ATTENDANCE RULES

Class attendance is mandatory, according to the Academic Regulations of the Higher Technical School of Engineering (ICAI). The requirements of attendance will be applied independently for theory and laboratory sessions:

- In the case of theory sessions, failure to comply with this rule may prevent the student from taking the exam in the ordinary period.
- In the case of laboratory sessions, failure to comply with this rule may prevent the student from taking the exam both in the normal and in the re-take periods.
- In any case, unjustified absences from laboratory sessions will be penalized in the grading.

BIBLIOGRAPHY AND RESOURCES

Basic References

- L. Pagola. Regulación Automática. Universidad Pontificia Comillas. 2006.
- Notes provided by the instructor in the course web page.