Syllabus
2024 - 2025

GENERAL INFORMATION

Data of the subject	
Subject name	Digital Control
Subject code	DEA-GITI-432
Mainprogram	Bachelor's Degree in Engineering for Industrial Technologies
Involved programs	Grado en Ingeniería en Tecnologías Industriales [Fourth year]
Credits	6,0 ECTS
Type	Optativa (Grado)
Department	Department of Electronics, Control and Communications

Teacher Information	
Teacher	
Name	Juan Luis Zamora Macho
Department	Department of Electronics, Control and Communications
Office	Alberto Aguilera 25 [D-212]
EMail	Juanluis.Zamora@iit.comillas.edu
Phone	2420
Teacher	
Name	Alberto Abanades Sánchez
Department	Department of Electronics, Control and Communications
EMail	aabanades@icai.comillas.edu

DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Prerequisites

Basic knowledge of Laplace Transform

Basic course on linear control systems

Matlab and Simulink

Course contents

Contents

1. Introduction to digital control systems. General scheme of a digital control system. Comparison between continuous and discrete-time controllers.

2. Discrete-time signals and systems. Concept of discrete-time signal and system. Z transform: definition, properties and transform of basic signals. Inverse Z transform. Discrete-time system: difference equation and transfer function. Relationship between time response and transfer function poles. Stability. Steady state response of stable systems.
3. Discrete-time feedback control systems. Effect of the output sampling and the control signal hold: approximation by a modified continuous model. Proportional control and influence of the sampling period. Exact discretization of the plant by a zero-order hold. Models for analysis and simulation of digital control systems. Dead-beat controllers.
4. Design and implementation of a discrete-time PID controller. Review of PID design by frequency response. Discretization methods for the controller: approximation of the integral and derivative terms.
5. State-space modeling. State-space linear and non-linear models. Electric and electronic circuits. Translational and rotational mechanical systems. Thermal systems. Hydraulic systems. Operating point and linearized model. Relationship between state-space model and transfer function.
6. Discrete-time state-feedback controllers. Exact discretization of a state-space continuous-time model. Design of a state-feedback regulator by pole placement. Methods for reference tracking: gain adjustment or integral action. State estimation: full and reduced-order observers.
7. State estimation. Open-loop estimator. Closed-loop estimators: full and reduced-order observers.

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Final exam	• Understanding of concepts. • Application of concepts to the resolution of practical problems. • Analysis and interpretation of the results obtained in problem solving. • Written communication.	60
Tests of experimental work and active participation in the laboratory	• Understanding of concepts. • Application of concepts to the resolution of practical problems. • Analysis and interpretation of the results obtained in problem solving. • Group work ability.	35
Short tests for continuous assessment	• Understanding of concepts. • Application of concepts to the resolution of practical problems. • Analysis and interpretation of the results obtained in problem solving. • Written communication.	5

Grading

December Examination Session:

- Final exam with a minimum of 5, 60%.

- Continuous assessment tests during the course, 5%.
- Laboratory grade with a minimum of 5, 35%.

June Examination Session:

- Final exam with a minimum of 5, 60%.
- Continuous assessment tests during the course, 5%.
- Laboratory grade with a minimum of 5, 35%.

The student is not examined in the June Examination Session for the part (theory or laboratory) that he or she has passed in the December Examination Session. Class attendance is compulsory, according to the Academic Regulations of the Higher Technical School of Engineering (ICAI). The attendance requirements will be applied independently for the theory and laboratory sessions: In the case of theory sessions, failure to comply with this rule may prevent them from taking the exam in the December Examination Session. In the case of laboratory sessions, failure to comply with this rule may prevent them from taking the exam in both the December and June Examination Sessions. In any case, unexcused absences from laboratory sessions will be penalized in the assessment.

BIBLIOGRAPHY AND RESOURCES

Basic References

- F. Luis Pagola. Control Digital. Universidad Pontificia Comillas, 2012
- N. S. Nise. Control Systems Engineering, 6th Edition. John Wiley and Sons. 2011.