Control Engineering I

Academic Year: (2023 / 2024) **Review date: 27-04-2023**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: MALFAZ VAZQUEZ, MARIA ANGELES

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Cálculo y Ampliación de matemáticas

OBJECTIVES

1. Know automatic control and control engineering and its application to robotics.
2. Acquisition of the ability to design control systems.
3. Acquisition of knowledge and understanding of control methods.
4. Acquisition of knowledge and understanding of the main mathematical tools used for the identification and modeling of systems and the ability to apply them.
5. Understanding of the operation of closed loop control systems.
6. Acquisition of technical and laboratory skills.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
2. Systems modeling
   a. Laplace transform
   b. Mathematical models
   c. Linearization
   d. Transfer function
      i. Blocks diagram
      ii. Mason's formula
3. Temporal analysis of systems.
   a. Introduction to temporal analysis.
      i. 1st order systems
      ii. 2nd order systems
   b. Reduced equivalent order systems.
   c. Stability analysis: Routh-Hurwitz criterion
4. Introduction to control systems. Errors in feedback systems.
   a. Control loop
   b. Errors and type of systems
   c. Sensitivity to disturbances
5. Temporal analysis of feedback systems. root locus.
   a. Root locus
   b. Inverse root locus
   c. Frontiers of the roots
6. Time domain PID regulators.
   a. PID control actions
   b. Temporal design of PIDs using the root locus
   c. Empirical PID tuning. Ziegler-Nichols methods
7. Frequency analysis of systems
   a. Frequency response of a system
   b. Bode plots
8. Frequency analysis of feedback systems to.
   a. Nyquist criterion.
   b. Relative stability: profit margin and phase margin.

9. Frequency design of PID regulators

LEARNING ACTIVITIES AND METHODOLOGY

- Master classes, doubt-solving classes in aggregate groups, individual tutorials and personal work by the student; oriented to the acquisition of theoretical knowledge (3 ECTS credits).

- Laboratory practices and problem classes in small groups, individual tutorials and personal work of the student; Oriented to the acquisition of practical skills related to the course program (3 ECTS credits).

ASSESSMENT SYSTEM

The continuous evaluation will consist of:

* Compulsory laboratory practices: 10%
* 2 midterm exams: 20% each

The final exam will be worth 50% and will have practical exercises and theoretical or theoretical-practical questions on any subject content. A minimum grade of 4 will be required in the final exam to pass the course.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- DiStefano et al Feedback and Control Systems , McGrawHill , 1990
- J. Wilkie, M. Johnson and R. Katebi Control engineering: an introductory course, Palgrave Macmillan, 2002
- NISE, N. S Control Systems Engineering, Wiley, 2011
- OGATA, K Modern Control Engineering, Prentice-Hall, 2010