29617 - Automatic Systems

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	430 - Bachelor's Degree in Electrical Engineering
ECTS	6.0
Year	2
Semester	Second semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

Learning process is done using lectures for theoretical concepts and also for solving problems and exercises. In all of them, especially on those dedicated to problems, the active participation of the students is promoted. Complementary to lessons, there is a set of laboratory sessions involving both simulation and real equipment that students must analyze and control. Finally, and depending on the available human resources, there is a personal work focused on practical skills, but that improves the theoretical topics covered in the course; this personal work is tutored by a teacher assigned to the student at the beginning of the course.

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After the course, students must be able to design automatic control systems, because they will know:

- To represent linear time-invariant (LTI) systems using transfer functions, and using block diagrams and their operation rules.
- To understand the typical feedback control loop.
- To understand the roles of the controller, the actuators, and the sensors involved in an industrial installation.
- To analyze and characterize LTI systems in both time and frequecy domains.
- To understand the relationships between proportional, integral and derivative actions with the steady-state response and with the transient response.
- To design a simple control scheme, and to choose the controller (estimating its parameters) in order to comply with the requirements for the response of the system.

5.2.Learning tasks

Face-to-face work: 2.4 ECTS (60 hours)

1. Face-to-face lessons (30 hours). Lessons in which a teacher exposes the theoretical and practical topics of the course. Student participation is promoted with questions and small discussions in the classroom.
2. Exercises and problems oriented lessons (15 hours). Lessons in a classroom in which a teacher proposes and solves exercises and small problems. Students are previously informed of what problems will be solved in the classroom, so they can work on them in advance. Problems are proposed in a coordinated scheduling with the theory.
3. Laboratory sessions (15 hours). Students simulate, analyze, start-up and operate small real control systems in a laboratory, in which a teacher assists them. They have in advance a script of the work to be done, and they must give a set of answers to theoretical and practical questions before to do the work at the lab.

Individual work: 2.6 ECTS (90 hours)

1. Individual study (86 hours). The student learns on its own the theoretical and practical topics of the course. This includes solving problems and exercises on its own. Teacher tutoring is included here, as an option for the students, which is useful to detect if they have learning difficulties, and to provide them some orientation in order to cope with them.
2. Individual practical work (15 hours). Depending on the available human resources to correctly carry out the tutoring of this part, there is a personal work focused on practical skills. At the end, the student must make a presentation of the work to the teacher, who was assigned to the student at the beginning of the course. So, if this work is done, these 15 hours will be subtracted from the ones of the previous paragraph, because this work helps the student to learn and understand the theoretical and practical contents of the course.
3. Evaluation and exams (4 hours). Beyond the basic purpose of them (to grade the student), evaluation is also a learning tool with which students test the level of understanding they reached.

5.3.Syllabus

Program:

1. Modelling continuous dynamic systems.
2. Analysis of the dynamic response in time domain. Steady-state response. Transient response.
3. Stability of dynamic systems.
4. Feedback.
5. Root Locus.
6. Analysis of dynamic systems in frequency domain. Bode diagrams. Simplified Nyquist stability criterion.
7. Relationships between specifications in time domain and frequency domain.
8. Design of Feedback control systems for dynamic systems: time domain.
9. Design of Feedback control systems for dynamic systems: frequency domain.
10. PID Control. Empirical tuning.
11. Advanced control schemes.

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Laboratory sessions:

1. Introduction to automatic control. Modelling of continuous dynamic systems: simulation using Matlab/Simulink.
2. Experimental identification of continuous systems.
3. Assisted simulation and analysis.
4. Evaluation of different controllers on a simple real system (aeropendulus).
5. Frequency domain analysis of dynamic systems. Frequency domain synthesis of PID controllers.

5.4.Course planning and calendar

The detailed calendar for both lessons in the classroom and practical sessions in the laboratories is fixed by the college for this course. Additional activities are advertised well in advance, mainly using dedicated internet sites and emails.

5.5.Bibliography and recommended resources

[BB: Bibliografía básica / BC: Bibliografía complementaria]

- [BB] Astrom, K.J. Feedback systems: An Introduction for Scientists and Engineers / K. J. Astrom, R. M. Murray. Princeton : University Press, 2008
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