Universidad Zaragoza

Academic Year/course: 2021/22

29817 - Automatic Control Systems

Syllabus Information

Academic Year: 2021/22
Subject: 29817 - Automatic Control Systems
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
326 - Escuela Universitaria Politécnica de Teruel
Degree: 440 - Bachelor's Degree in Electronic and Automatic Engineering
444 - Bachelor's Degree in Electronic and Automatic Engineering
ECTS: 6.0
Year: 2
Semester: Second semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

The objectives of the Automatic Systems subject are the following:

? Assimilate the structure of the classic regulation loop.

? Understand the function of the regulator, the actuators and the sensors.

? Describe the relationship that exists between proportional, integral and derivative actions with the response in a permanent and transitory regime of a process.

? Understand and assimilate the design technique of regulators in the time domain by the method of cancellation of poles and the place of the roots.

? Understand and assimilate the design techniques of regulators in the frequency domain.

? Assimilate and understand the different constructive forms or architectures of the programmable automatons.

? Introduction to programming Automata

? Assimilate and understand the modeling process of discrete Event Systems using Petri nets.

? Acquire design capacity of control and regulation systems.

? Acquire capacity for the use of programmable controllers in the control of continuous processes.

? Acquire capacity for modeling and programming of discrete event systems.

1.2. Context and importance of this course in the degree

Automatic systems is a subject of the branch of industrial technologies. In this context, the basic concepts of systems control are presented.

The students have studied the math, physics, electrical engineering and Signals and Systems necessary to understand the basic principles used in the subject in previous semesters. The student learns in the subject to analyze and design classic control loops and other control structures. He is also introduced to computer control.

At the end of the course the student is able to understand the importance of systems control and its importance in industrial processes from the technical, economic and environmental point of view. The knowledge acquired serves as the basis for subjects such as Control Engineering and Industrial Automation.

1.3. Recommendations to take this course

For pedagogical and content reasons it is advisable to have studied Mathematics, Physics, as well as the subjects of Fundamentals of Electrotechnics, Electrotechnics and Signals and Systems. The previous study of these subjects provides the student with the basic tools necessary to develop, analyze and simulate industrial control systems.

The study and continued work, from the first day of the course, are fundamental to overcome with the maximum advantage the subject.

It is important to resolve any doubts that may arise as soon as possible, for which the student has the advice of the teacher, both during the classes and in the hours of tutoring intended for it.

2. Learning goals

2.1. Competences

Upon passing the subject, the student will be more competent to ...

Apply the fundamentals of automatisms and control methods.

Combining basic knowledge and specialized engineering to generate innovative and competitive proposals in the professional activity.

Solve problems and make decisions with initiative, creativity and critical reasoning.

Apply information technologies and communications in Engineering.

Use the techniques, skills and tools of Engineering necessary to practice it.

Learn continuously and develop autonomous learning strategies.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

Know the properties of feedback and basic control actions.

Knows and knows how to apply control design techniques of monovariable continuous systems, in the time domain.

Knows and knows how to apply the control design techniques of monovariable continuous systems, in the frequency domain.

Knows and knows how to select basic control schemes.

He knows how to design logical automatisms based on finite state automata and Petri nets.

Knows and knows how to apply the basic techniques of automation programming in programmable automata.

2.3. Importance of learning goals

The knowledge acquired by the student in Automatic Systems starts him in the control and automation of a large number of manufacturing tasks. A large part of these tasks or processes fall into two main groups:

Knowledge about Continuous Systems allows you to address tasks such as: Motor speed control, temperature control, torque control, flow control.
The knowledge about Discrete Event Systems allows you to tackle tasks such as: Control of manufacturing operations, assembly, maintenance, storage ...
Currently in these processes has reached a high degree of automation. The control of operations is carried out by industrial regulators, industrial computers, programmable automata, robots ...

The learning results of this subject give students the ability to analyze real situations of control of drives and industrial processes and enable them to propose schemes and calculate the appropriate control parameters that allow meeting certain operating requirements. These results, and the capacities and abilities derived from them, have a great importance in the industrial environment, where the control of processes and systems is a key and fundamental piece for the development of the product, allowing to reduce costs, both economic and environmental, and increase the final quality of the product.

3. Assessment (1st and 2nd call)

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

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Individual written test (80%). Rated between 0 and 10 points (CT).
Evaluation of practical credits (CP). Qualified between 0 and 10 points (CP), can be overcome throughout the course. It will be formed by:

Practical work (12%)
Laboratory practices (8%).
In any case, there will be a specific individual test of the practical credits during the evaluation period for students who have not passed the course during the course, or who wish to upload a grade.

In order to pass the subject, it is essential to obtain a CP score greater than or equal to 4 points. Only in this case, the global qualification of the subject will be (0.20 * CP + 0.80 * CT). In another case, the overall rating will be the minimum between 4 and the result of applying the previous formula. The subject is exceeded with an overall score of 5 points out of 10

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that is designed for this subject is based on the following:

The teaching process will involve three main levels: lectures, problems and laboratory, with an increasing level of student participation.
? In the lectures the theoretical basis of the automated systems will be presented, illustrated with numerous examples.
? In the classes of problems and issues, such cases will be developed involving students.
? Laboratory practices will be developed in small groups where students perform the simulation, implementing and analyzing real automation and control systems.
? In addition, to encourage continuous and autonomous student work, additional learning activities to do throughout the semester will be performed.

4.2. Learning tasks

The course includes the following learning tasks

Classwork: 2.4 ECTS (60 hours)

1) In-person class (type T1) (30 in-person hours).

Lectures of theoretical and practical content. The concepts and fundamentals of automatic systems are presented, illustrated with real examples. Student participation through questions and brief discussions will be encouraged.

2) Classes of problems and case resolution (type T2) (15 in-person hours).

Problems and cases involving students, coordinated at all times with the theoretical contents will be developed. Students are encouraged to work on the problems previously. Some of these hours may engage in learning activities assessable as specified in each course.

3) Lab (type T3) (15 in-person hours).

The student will perform the simulation, implementing and analyzing real automation and control systems. A script practice will be available, consisting of sections of previous study and practical realization in the laboratory. The preliminary study must be worked out before the practice. Each practice will be qualified in the laboratory.

Non-in-person work: 3.6 ECTS (90 hours)

4) Study (type T7) (86 non-in-person hours).

Student Personal study of the theoretical part and realization of problems. The ongoing work of the student will be encouraged by the homogeneous distribution of the various learning activities throughout the semester. This includes tutorials, as direct support for the student, identification of learning problems, orientation in the subject, advising to exercises and assignments.

5) Evaluation tests (T8) (4 in-person hours).

In addition to the qualifying function, evaluation is also a learning tool with which the student checks the degree of understanding and assimilation reached.

4.3. Syllabus

The course will address the following topics:

- Lesson 0 Presentation of the subject. Historical introduction
- Lesson 1 Control of Discrete Event Systems. Introduction to Industrial Automation Systems. Industrial Programmable Logic Controller. Digital and Analog inputs and outputs. Sensors and actuators. Programming Discrete Event Systems.
- Lesson 2 Feedback systems. Properties feedback systems. Steady-state response. Precision. Root locus. Phase and gain margin. Relationship between time and frequency response. Nyquist stability criterion simplified case.
- Lesson 3 Control of Dynamic Systems. Feedback systems properties. Steady-state response. Precision. Basic control actions. Controller design. Cancellation of poles and zeros. Root locus. Design of controllers in the frequency domain
- Lesson 4 Control Structures. Modifications PID control. Feedforward. Servo drive. Cascade control.
- Lesson 5 Industrial Control. Industrial PID controllers. PID control technology. Feedforward control. Control ratio. PWM action. Servo action. Heat Cool action. Empirical tunning.

Practices to perform are:

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? Introduction to Programmable Logic Controller.

? Control of discrete event systems. Control stations of the manufacturing cell.

? Control position and speed of a servomotor.

? Control model of a mini

? Implementation of PID controllers in PLCs.

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? Introduction to Programming Logic Controller.

? Control of discrete event systems.

? Control of continuous systems. Aeropendulum 1

? Control of continuous systems. Aeropendulum 2

? Implementation of PID controllers in PLCs.

4.4. Course planning and calendar

Lectures and problem classes and practice sessions are held in the laboratory according to the schedule set by the center (schedules available on their website).

Each teacher will inform about their hours of tutoring.

The other activities will be planned depending on the number of students and will be announced in good time. It will be available on http://add.unizar.es