30127 - Automatic Systems

Información del Plan Docente

Academic Year	2017/18
Faculty / School	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	425 - Bachelor's Degree in Industrial Organisational Engineering 457 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Year	
Semester	First 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

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

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* Theoretical classes: Theoretical activities imparted in a fundamentally expository way by the teacher, in such a way as to expose the theoretical supports of the subject, highlighting the fundamental content, structuring it in themes and relating those themes to each other.

* Practical classes: The teacher explains and helps in understanding the use and management of necessary software for configuring and programming control devices (PLC's)

* Laboratory practices: Students will perform tests, measurements, assemblies, etc. in the laboratories arranged in groups, following a script provided by the teacher.

* Individual tutorials: They will be carried out in the department through a personalized attention to the student, with the goal of solving the doubts and difficulties the student faces. These tutorials can be carried out either face-to-face or virtually.

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

- Presentation of the course contents in master classes. During the lectures the professor will often refer to real-world examples related to the concept being introduced, both from the civilian and militar contexts.
- Resoultion of problems and exercises with the involvement of the students.
- Development of laboratory sessions guided by professors using simulation tools with the goal of digging deeply into the theoretical contents.
- Personal study of the subject by students.

It is useful to keep in mind that the course has both theoretical and practical orientation. Therefore, the learning process emphasizes both student participation in lectures, and conducting laboratory practices and solving excercise and problems.

5.2.Learning tasks

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The course consists of 6 ECTS credits, which represent 150 hours of student's work during the semester, which would equal to 10 hours every week during the 15 weeks the semester lasts.

The degree of experimentation is deemed high.

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The student's activities in this semester, organised by duration are as follows:

- 25 hours of master classes (theoretical teaching and problem solving)
- 25 hours of laboratory practice, arranged in 2 hour sessions
- 10 hours of tests (written and practical)
- 90 hours of personal studying

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The master classes are organized as:

- Theory: Theorectical concepts are introduced with examples based on real systems related with the future work place of the students. Also, excercises will be solved in the classroom to help the assimilation of the theoretical concepts.
- Laboratory: Practical modeling, analisys and control of real systems simulated in a computer.

The subject consists of 6 ECTS credits that correspond to 150h of students' work.

The work is distributed as follows:

- 47-49h of master classes (theory and excercise)
- 6-8h of laboratory sessions (2h each)
- 5h of exams and tests
- 90h of students' personal study

Before the beginning of the semester, the professors will provide to the students the schedule of the activities using the Moodle platform. This can be consulted going to http://moodle.unizar.es and authenticating with their username and password.

They will find the detailed course program, teaching documents and recommended bibliography in addition to suggestions to follow it.

Additionally, it is possible to find information such as the classes calendar and hours at the web page of the Centro Universitario de la Defensa: http://cud.unizar.es .

5.3.Syllabus

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Theoretical contents

1.- Automatic control systems

- Introduction
- Control systems
- Transfer function. Laplace transform.

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    - Poles and zeros
    - Control system stability
    - Control system order
- Regulators
    - (P, I, D, PID, All or Nothing)

2.- Elements of a control system

- Transducers
- Comparators
- Regulators and controllers
- Actuators
    - Servomotors, stepper motors.

3.- PLC architecture

- RAM, ROM, ALU, PSW.
- Digital I/O
- PAE and PAA
- Marks
- Scan cycle

4.- PLC configuring and programming

- Timers and counters
- Flanks
- Comparing and jumps
- Functions

5.- Industrial communications

- Industrial buses. (Profibus, Profinet).

Practical contents

1.- Process control (discrete)

- Industrial processes simulation models
- Flexible cell control

2.- Frequency variable

- Configuring and programming

Three phasse asynchronous engine speed control

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Unit 1: Systems modeling
Theme 0: Introduction of the subject.

Theme 1: Introduction to Automatic Systems.

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- Introduction.
- Definitions and terminology.

Theme 2: Preliminary concepts.

- Complex numbers.
- Laplace Transform.

Theme 3: Modeling of mechanical and electrical systems.

- Traslational systems.
- Rotational systems.
- Electrical systems.
- Electrical-mechanical systems: DC motor.
- Transfer function.
- Block diagrams.
- Equivalencies and simplification of block diagrams.

Unit 2: Analysis of continuous time systems

Theme 4: Model and dynamic response of 1st and 2nd order systems, higher order.

- Elements that influence output behavior.
- Standard inputs.
- Step response of 1st order systems.
- Step response of 2nd order systems.
- Step response of higher order systems.
- Influence of zeros on the output behavior.
- Systems stability.
- System stability analysis through Routh criterion.

Theme 5: Feedback systems analysis.

- Feedback systems.
- Steady state error en feedback systems.
- Perturbations.

Unit 3: Systems control techniques

Theme 6: Analysis through root locus techniques (RL).

- Definition of root locus.
- Phase and magnitude conditions.
- RL approximation through basic rules.
- Analysis of feedback systems through RL.

Theme 7: Controller design through RL.

- Analysis of control requisites in the complex plane.
- Transient state control.
- Steady state control.
- PID.

Theme 8: Frequency response analysis through Bode diagrams.

- Frequency response of linear systems.
- Representation of the transfer functions using phasors: phase and magnitude.

- Frequency response graphical representation.
- Asymptotic Bode diagrams.

Theme 9: Controllers design using Bode diagrams.

- Analysis of the requisites from the frequency viewpoint.
- Steady and transient states control.

Unit 4: Discrete-time systems

Theme 10: Logical sequential and concurrent systems.

- Logical automatism: definition.
- PLC controllers.
- Modeling of DTS using Petri nets.

5.4.Course planning and calendar

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The schedule for the realization of both the master classes and the practices will be established by the center at the beginning of each course. (This schedule will be published in the center's website).

The rest of activities (Practices handing-in, evaluation test, etc...) will be planned according to the necessary groups and will be communicated to the students in advance at the beginning of the course.

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Individual work presentations will be advertise during the lectures or using the web platfom Moodle: http://moodle.unizar.es

Calendar activities and the schedule of lectures will be published in the CUD webpage: http://cud.unizar.es .

5.5.Bibliography and recommended resources

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THE UPDATED BIBLIOGRAPHY OF THE SUBJECT CAN BE CONSULTED THROUGH THE LIBRARY WEB PAGE http://psfunizar7.unizar.es/br13/eBuscar.php?tipo=a

Universidad Zaragoza

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BB	González Rueda, Emilio. Programación de autómatas SIMATIC S7-300 : (lenguaje AWL) / Emilio González Rueda Barcelona : CEYSA, [2004]
BC	Guerrero, Vicente. Comunicaciones industriales / Vicente Guerrero, Luis Martínez, Ramón L. Yuste. - 1ª ed Barcelona : Marcombo, cop. 2010

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BB	Nise, N. S. Sistemas de Control para Ingeniería.. 1ª ed. México: CECSA, 2002
BC	Kuo, Benjamin C. Sistemas de control automático / Benjamin C. Kuo ; traducción, Guillermo Aranda Pérez ; revisor técnico, Francisco Rodríguez Ramírez . - 1ª ed. en español México [etc.] : Prentice Hall Hispanoamericana, cop. 1996
BC	Lewis, Paul H. Sistemas de control en ingeniería / Paul H. Lewis, Chang Yang . - 1a ed. en español Madrid : Prentice Hall, cop. 1999
BC	Ogata, Katsuhiko. Ingeniería de control moderna / Katsuhiko Ogata ; traducción Sebastián Dormido Canto, Raquel Dormido Canto ; revisión técnica Sebastián Dormido Bencomo ; revisión técnica para Latinoamérica Amadeo Mariani ... [et al.] . - 5ª ed. Madrid : Pearson Educación, D.L. 2010