30127 - Automatic Systems

Información del Plan Docente

Academic Year	2016/17
Academic center	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	425 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering 457 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Course	
Period	First semester
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

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

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Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject Sistemas automáticos is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, at the same time supported by other activities

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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 activities

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The pragramme offered to the students to help them adquier their target result is made up of the following activities:

It involves the active participation of the student, in susch a way that for archiving the learning target, not talling away from those already setout, the following activities will be developed:

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Face-to-face generic activities

- Theory classes: The teoretical concepts of the subjets are explained and illustrative examples are developed as support to the theory wen neccesary.
- Practical classes: Problems and practical cases are carried out as complementary to the studied theorical concepts.
- Laboratory workshop: groups of students will carry out these activies guided / tutored by the teacher.

The subjets has 6 ECTS credits, which represents 150h of students work in the subjets during the semestes, in order words, 10 hours per week during 15 weeks of class.

The level of experimentation considered for the subjets is considered high.

Talling into account the overall schendule of the subjet, the activities of the students (in this subjets) are distributed as follows:

- 25 hours of lecture / theory clases (theoretical demostration and solving type problems)
- 25 hours of laboratory workshop (2 hours session)
- 10 hours of assessment test (writen and practical)
- 90 hours of personal study.

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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.Program

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Contents of the subjets requiered to archieve the target result.

The guidelines followed to elaborate the contents were as follows:

- The contents proposed in the check memory are respeted
- a syllabus whose chapters generaly match the tittle of the specified program was developed.

Theorical content:

1.- Automatic control system.

- Introduction
- Control System
- Transfer function. Laplace transform
  - Poles and Zeros.
  - Stability of a control system.
  - order of a control system.
- Regulators
  - (P, I, D, PID, all or nothing)

2.- Elements of a control system.

- Transducersomparators.
- Controllers.
- Actuators.
  - Servomotors, step by step motors.

3.- Architecture of a PLC

- RAM, ROM, ALU,PSW.
- Digital E/S.
- PAE and PAA
- Brands
- Scan Cycle

4.- Configuration and programing of PLC

- Timers an couters.
- Flanks
- Aritmetic operations
- Comparisons and jumps
- Functions
- Data blocks
- Organitations bloks

5.- Sensors and industrial detectors

- Inductive and capacitive sensors.
- Photocells
- Temperature and pressure sensors
- Load cells

6.- Grafcet

7.- Industrial communications.

- MPI communication
- Industrial Buses
  - Profibus, profinet

Practical contents

1.- Process control (discrete)

- Industrial processes simulation models.
- Flexible cell control.

2.- Frecuency inverter.

- Configuration and programming comercial trade inverters
- Asyncronous Three- phase motor 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.Planning and scheduling

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The schedule of the lectures as welles the carrying out of the practices will be established by the centre at the beginning of each corse (This timetable / schedule will be published on the website of the centre).

Other activities (Handing of practices, assessment test etc) are planned according to number of groups and communicate to students in advance at the begining of 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 recomended resources

SPECIALIZATION IN BUSINESS

BB	González Rueda, Emilio. Programación de autómatas SIMATIC S7-300 : (lenguaje AWL) / Emilio González Rueda Barcelona : CEYSA, [2004]

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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