DEGREE CURRICULUM

FUNDAMENTALS OF CONTROL THEORY

Academic year 2015-16

BASICS OF THE CONTROL THEORY 2015-16

Subject's general information

Subject name	Fundamentals of Control Theory
Code	102124
Semester	1r Q Avaluació Continuada
Typology	Obligatòria
ECTS credits	6
Theoretical credits	6
Practical credits	0
Office and hour of attention	by agreement
Department	Informàtica i Enginyeria Industrial
Teaching load distribution between lectures and independent student work	(40%) 60 h classroom (60%) 90 h autonomous work
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Idioma Percentatge d'ús Anglès 10.0 Castellà 10.0 Català 80.0
Degree	Degree in Automation and Industrial Electronic Engineer
Office and hour of attention	by agreement
E-mail addresses	ramon.costa@upc.edu

BASICS OF THE CONTROL THEORY 2015-16

Ramón Costa Castelló

Subject's extra information

For a proper development of the teaching, is needed that the student has already reach the basic knowledge of general topics like differential equations, Laplace's Transforms and previous knowledge in Dynamics, Circuit's Theories and Electronics In order to reach the evaluations in a satisfactory level is recommended to be present at the lecture sessions and to have an active participation in them. Apart, is recommended that the student solves by its own the proposed exercises and the regular crosscheck of the bibliography.

The subject is defined to form specialists in Automation; it develops the theoretical basic knowledge in terms of Automation Controls that will be used as a basis for the learning of other graduation subjects and the future professional exercise. The study of the subject implies that the student is getting the basic needed knowledge to understand, analyze, design and evaluate Automation Control Systems. For that, is necessary to introduce to the student the Linear Control systems by the classic analysis techniques and system designs in the time-domain and frequency-domain performances.

Learning objectives

see competences

Competences

Degree-specific competences

- Knowledge of automatic regulation and control techniques and their application to industrial automation.
- Ability to design control and industrial automation systems.
- Knowledge of the basis and applications of robotic systems.
- Ability to design analogical, digital and high-power electronic systems.
- Knowledge and ability to make models and simulate systems.

Degree-transversal competences

- Ability to resolve problems and elaborate and defend arguments inside their field of study.
- Ability to gather and interpret relevant data in their field of study, and to emit judgements that include a reflection on relevant themes of a social, scientific or ethical nature.

Subject contents

1st subject: Basic Concepts. Physical systems mathematical modeling. Open and closed loop controls. Analysis and synthesis of control systems.

2nd subject: Mathematical models. Linearization. Laplace Transform. Linear time-invariant system resolution (L.T.I)

3rd subject: Control systems representation. External representation. Transfer function. Block diagrams, Signal Flow diagrams.

Mason's rule, internal representation, state-variable modelling.

4th subject: Physical systems mathematical modeling. Dynamic systems representation, electrical, mechanical,

thermal and hydraulic systems.

5th subject: Time domain analysis. Typical input signals, convolution, Impulse Response. First and second order systems.

Superior order systems. Basic actions of control, Stability Routh Criteria

6th subject: Stationary response. Precision, system's error measuring. Sensibility

7th subject: System analysis by root-locus system. Root contour.

8th subject: Design techniques of control systems by root-locus method. Design specification. P, PI, PD and PID regulators.

9th subject: Control System analysis by frequency domain performance techniques. Polar plot representation, Bode diagrams, Nichols Chart.Stability. Nyquist criterion

10th subject: Control System analysis by frequency domain performance techniques. Phase advanced compensation. Phase delay compensation.

11th State variable system analysis: State diagrams. Characteristic vector and values. Transition state matrix. Controllability and Observability

Methodology

Master class

Problem-based learning

Classroom Practices

Development plan

Develops sequentially contents

Evaluation

Evaluation Method

During the semester, there shall be four assessments in the form of two written tests and two papers that account for the study and the work done in the labs. These documents will have a maximum score of 1 point each and not considered any improvement threshold. The two written tests will be held on dates determined by the EPS for this purpose.

In this course, by its nature, has little sense to evaluate parts of avoiding your stuff previous contents. Thus, each written test will be on all the stuff that has been given so far.

The first written test will have a maximum score of 3 points and be considered approved if the score is greater than or equal to 1.5 points. The second written test will have a maximum score of 5 points and will be considered approved if the score is greater than or equal to 2.5 points.

As the material is cumulative in each written test, if the second test is passed, then the first test will be compensated if the latter has not been surpassed, with half its maximum score (1.5 points).

> -The total score is the sum of the notes of the 4 reviews. **(This is the first of the two possible pathways of qualifications that are contemplated)**.

> -If the second written test you get a lower score to 2.5 points, you must use the recovery activity, to be performed on the date set by the EPS. The written test will have a valuation recovery maximum 8 points and be deemed to have been passed if you get a note added to the laboratory practice notes and document preparation practices study is greater than or equal to 5 points. (**This is the second pathway**)

In addition:

Any person enrolled in this course, that have made the 2nd written test whether or not it has been overcome, be furnished to the recovery activity to increase the final grade. If the 2nd test had been overcome the final grade will never be lower than it would have obtained by the first approach.

Bibliography

Recommended bibliography

Control Systems, Katsuhiko Ogata.

Automatic Control Systems, Benjamin Kuo.

Sistemas de Control, Hostetter