PERSONA CIENCIA EMPRESA
Universitat Ramon Llull

COURSE: AUTOMATION

SUBJECT: Automation
MODULE: Specific Technology
STUDIES: Degree on Industrial Technologies Engineering

GENERAL FEATURES*

Type: ☐ Basic training, ☑ Mandatory, ☐ Optional

☐ Final degree project, ☐ External practices

Duration: Semestral **Semester/s**: 8
Number of credits ECTS: 6
Language/s: Spanish

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION

This course provides an overview of the principles of automatic regulation. Basing the analysis in linear systems, we examine the analytic representation of some physical systems from mathematical models by introducing the concept of block diagram, transfer function, Laplace transform and feedback control. An analysis of systems in the time domain and frequency to introduce the concept of stability, PID controller design, and state space systems.

COMPETENCIES

• Capacity to understand and apply basic technical knowledge (E2).
• Knowledge of materials science and technology that enables them to learn new methods and theories and given a versatility to adapt to new situations (E3).
• Ability to solve problems with initiative, decision making, creativity, and critical thinking (E4).
• Ability to communicate effectively, both orally and in writing, to impart knowledge, skills and abilities in the field of industrial engineering (T1).
• Knowledge of the principles of automatic regulation and its application to the industrial automation (TE2).

PREREQUISITES*

The competencies associated with earlier stages of education.

CONTENTS

1. Introduction to feedback control systems.

2. Transfer fonction:
   - Laplace transform.
   - Transfer fonction concept.

- System classification.

3. Dynamic system modelling:
   - Block diagrams.
   - Model exemples.

4. Time domain analysis:
   - First order systems.
   - Second order systems.
   - Higher order and dead time systems.
   - Time response parameters.

5. Controllers and tuning:
   - Proportional, integral, derivative and on-off actions.
   - Error criteria.
   - PID controllers tuning.

6. Stability:
   - Routh-Hurtwitz criterion.
   - Root-locus.
   - Sensibility

7. Frequency analysis:
   - Bode and Nyquist diagrams.
   - Nyquist stability criterion.
   - Gain and phase margins.

8. Introduction to space state control:

METODOLOGY

TRAINING ACTIVITIES*

Training activities	ETCS credits	Competencies
Concept sessions	1,5	E2, E3, E4, TE2
Exercise, problem and case sessions	0,5	E2, E3, E4, TE2
Compulsory activities at the teacher's office	0,1	E2, E3, E4, TE2, T1
Practical work / laboratory	1,6	E2, E3, E4, TE2, T1

* These features should not be modified without the approval of organs responsible for the high-level academic structures (subject, module and/or study plan).

Personal study activities	2,2	E2, E3, E4, TE2
Evaluation activities (testing, monitoring controls…)	0,1	E2, E3, E4, TE2
TOTAL	6,0	

EXPLANATION OF TEACHING METHODOLOGY

The teaching is done through lectures, problem solving sessions and laboratory works. Lab work consists of professor explanations, delivery of the practice protocol and writen report.
measurements and observations found for the personal study the student provides
Complete documentation of the course with theory, problems, protocols for laboratory tests, and MATLAB / SIMULINK tools are provided to students.

EVALUATION

METHODS OF EVALUATION*

Methods of evaluation	**Weight**	**Competencies**
Final exam	40%	E2, E3, E4, TE2
Partial exams	40%	E2, E3, E4, TE2
Lab reports	5%	E2, E3, E4, TE2, T1
Practical works / laboratory	10%	E2, E3, E4, TE2
Participation	5%	
TOTAL	100%	

LEARNING OUTCOMES

- The student must demonstrate theoretical and practical knowledge of basic concepts in automatic regulation. (E2, E3, E4, TE2)
- The student must demonstrate proficiency in understanding, planning, and resolution of industrial automation systems (E2, E3, E4, TE2, T1)

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EVALUATION

The evaluation of the subjet will consider all the aspects that appear in the table of evaluation with their corresponding weight. Each one of the activities (final examination of theory, final examination of problems, average of controls, laboratory and information of laboratory), must have a minimum grade of 4,5 points to have right to pass the subjet. In the case of not having all the activities with grade equal or superior to 4,5, attainable the maximum final grade will be of 4,5, by means of average of the continued evaluation (controls) and final examination.

EVALUATION OF COMPETENCIES

Examinations, scheduled checks, monitoring and testing labs are used to evalate the course competencies (E2 E3, E4, TE2, T1).

BIBLIOGRAFY

- K. Ogata, “Ingeniería de Control Moderna”, Prentice Hall
- F.G. Shinskey, “Process-Control Systems”, McGraw-Hill
- P. Harriott, “Process Control”, McGraw-Hill
- P.H. Lewis, C. Yang, “Sistemas de control en ingeniería”, Prentice Hall
- J. Dorsey, “Sistemas de control continuos y discretos”, McGraw Hill

DOCUMENT RECORD

PREVIOUS CHANGES

May 2014.	Dr. Eduard Barberà
June 2013.	Dr. Eduard Barberà
July 2012.	Eng. Sauro J. Yagüe
February 2012.	Eng. Sauro J. Yagüe.

LAST REVISION

February 2015	Dr. Eduard Barberà