DEGREE CURRICULUM

CONTROL AND ROBOTICS SYSTEMS DESIGN

Coordination: TRESANCHEZ RIBES, MARCEL

Academic year 2016-17

CONTROL AND ROBOTICS SYSTEMS DESIGN 2016-17

Subject's general information

Subject name	CONTROL AND ROBOTICS SYSTEMS DESIGN
Code	102127
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	<table><tr><th>Degree</th><th>Course</th><th>Typology</th><th>Modality</th></tr><tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr></table>
ECTS credits	6
Groups	1GG,2GM,4GP
Theoretical credits	2
Practical credits	4
Coordination	TRESANCHEZ RIBES, MARCEL
Department	INFORMATICA I ENGINYERIA INDUSTRIAL
Teaching load distribution between lectures and independent student work	Total load: 150h - 60h of lectures (40%) - 90h of independent student work (60%)
Important information on data processing	Consult this link for more information.
Language	Catalan
Distribution of credits	4 Credits of lectures and practical examples in big groups (GG) 2 Credits of practical work in small groups (GP)
Office and hour of attention	Office (2.07) or Robotics Lab (2.04) at the EPS building. Monday 10:00-11:00 AM.

CONTROL AND ROBOTICS SYSTEMS DESIGN 2016-17

Professor/a (s/es)	Adreça electrònica professor/a (s/es)	Crèdits	Horari de tutoria/lloc
TRESANCHEZ RIBES, MARCEL	mtresanchez@diei.udl.cat	9,8	Wensday 17-18h, 2.07 EPS

Subject's extra information

It is recomended to have coursed previously “Senyals i Sistemes” and “Teoria Bàsica del Control” subjects.

Learning objectives

Acquire the ability to design control and industrial automation systems.

Know the working of control systems in robotic systems.

Learn principles and applications of robotic systems

Identify and analyze the different parts of a robot

Understand the operation of a robot and be able to planning their possible application

Learn to develop graphical interfaces to manage control systems.

Competences

Cross-disciplinary competences

EPS1. Capacity to solve problems and prepare and defence arguments inside the area of studies.

EPS2. Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.

Specific competences

GEEIA25. Knowledge and capacity for modelling and simulation of systems.

GEEIA26. Knowledge of automation and technical regulation of control and his application to the industrial automation.

GEEIA27. Knowledge of principles and applications of robotic systems.

GEEIA29. Capacity to design systems of industrial automation control.

Cross-disciplinary competences

EPS1. Capacity to solve problems and prepare and defence arguments inside the area of studies.

EPS2. Capacity to gather and interpret relevant data, within the area of study, to judge and think about relevant subjects of social, scientific and ethical nature.

Subject contents

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1. Introduction to robotics

    1.1. Robots classification

    1.2. Sensors and actuators

    1.3. Stepper motors and DC motors

    1.4. Electronic solutions for motor controlling

    1.5. Examples of robotics systems

2. Robot control

    2.1. Direct kinematics model

    2.2. Methodology of Hartenberg-Denavit

    2.3. Inverse kinematics model

3. Graphical design of control systems

    3.1. Graphical interfaces

    3.2. Development of discrete controllers

    3.3. Programming of graphical environments for control

    3.4. Examples of applied control

4. Control based on artificial vision

    4.1. Global processing operations

    4.2. Filters and convolutions

    4.2. Image processing techniques

3. Applications

    3.1. Programming of robots in industry

    3.2. Feedback control of robots using image processing

Methodology

The development of the subject will be based on the practical work performed at different laboratories of the university.

The contents and description of the practical work will be available at the web.

The development of the practical work will be based on the MATLAB programming environment.

There will be a final work about the control of a cartesian robot with vision system. This practical work will be done in small groups (GP) during the period for perform the practices 6 and 7 specified on the developement plan.

Development plan

Week	Description	Classroom Activity	Classroom Hours	Student workload Hours
1	Presentation	masterclass	2	0
	Lesson 1: Lecture	masterclass	2	4
2	Lesson 1: Lecture	masterclass	2	4
	Lesson 2: Lecture	masterclass	2	4
3	Lesson 2: Experimental	Experimentation	2	5
	Lesson 3: Lecture	masterclass	2	12
4	Lesson 3: Exercices	Practical exercise 1	2	0
	Lesson 3.1: Experimental	Experimentation	2	8
5	Lesson 3.1: Practices	Practical exercise 2	4	0
6	Lesson 3.2: Experimental	Experimentation	4	8
7	Lesson 3.2: Practices	Practical exercise 3	2	0
	Lesson 3.3 i 3.4: Lecture	Experimentation	2	10
8	Lesson 3.3: Practices	Practical exercise 4	4	3
9	Evaluation exam 1	Practices doubts	2	5
10	Lesson 4: Lecture	Experimentation	4	10
11	Lesson 4: Exercices	Practical exercise 5	2	0
11-12	Lesson 4: Practices	Practical exercise 6	4	2
12	Lesson 5: Lecture	Experimentation	2	3
13-14	Lesson 5: Final project	Practical exercise 7	8	1
15-16	Evaluation exam 2	Practices doubts	2	5
17	Tutorials	Tutorials	2	0
18	make-up exam	Evaluation	2	6

During the period for develop de last two practices (11, 12, 13 and 14 weeks) the sessions will be done in small groups of students (GP). The rest of sessions, if are space enough and licenses, will be done in big groups of students (GG).

Evaluation

The evaluation is based on the weighted practical work performed during the course.

NC = (**NP1*P1 + NP2*P2 + NP3*P3 + NP4*P4 + NP5*P5 + NP6*P6)**

If **NC** is lower than 5.0 there will be an optional exam with a weight of 8 points, the final mark will be computed with:

NF = **NR** + (**NC** x **0,2**)

Bibliography

- Notes from the subject.

- Philip J. McKerrow, Addison-Wesley: **Introduction to Robotics.** ISBN 0-534- 914370-5.

- A. Barrientos, L.F. Peñín, C. Balaguer, R. Aracil: **Fundamentos de robótica**, McGraw Hill, 1997. ISBN: 8448108159.

- K.S. Fu, R.C. González, C.S.G. Lee. McGraw-Hill: **Robótica: Control, Detección, Visión e Inteligencia.** ISBN 84-7615-214-0

- P. M. Taylor, Eds. Ceac: **Control Robótico.** ISBN 0-333043821-3

- Reyes Cortés, Fernado, Robótica: **Control de robots manipuladores**. Barcelona: México: Marcombo: Alfaomega 2011. ISBN: 9788426717450.

- Craig, John J.: **Robótica**. 3a ed. México: Pearson Educacion, 2006. ISBN: 9702607728.