Universitat de les Illes Balears

Teaching guide

Academic year	2016-17
Subject	11567 - Vision Control
Group	Group 1, 2S
Teaching guide	B
Language	English

Subject identification

Subject	11567 - Vision Control
Credits	0.72 de presencials (18 hours) 2.28 de no presencials (57 hours) 3 de totals (75 hours).
Group	Group 1, 2S (Campus Extens)
Teaching period	Second semester
Teaching language	English

Professors

Lecturers	**Horari d'atenció als alumnes**					
	Starting time	**Finishing time**	**Day**	**Start date**	**Finish date**	**Office**
Alberto Ortiz Rodríguez alberto.ortiz@uib.es	You need to book a date with the professor in order to attend a tutorial.					

Contextualisation

The main objective of the course "Vision-based Control" is to provide students with an overview of discrete-time control design methods with a particular emphasis on vision-based control. Because of the diverse backgrounds of interested students, the contents of the subject are articulated so that overall result as self-contained as possible.

Requirements

Skills

Specific

* CE10 - Ability to understand and to apply advanced knowledge of high-performance computing and numerical or computational methods to engineering problems.
* CE11 - Ability to design and develop systems, applications and services in embedded systems and ubiquitous.
* CE12 - Ability to apply mathematical, statistical and artificial intelligence to model, design and develop applications, services, intelligent systems and knowledge-based systems methods.

Generic

* CG1 - Ability to design, calculate and design products, processes and facilities in all areas of Computer Engineering.

Date of publication: 25/07/2016

* CG4 - Capacity for mathematical modeling, calculation and simulation technology and engineering business centers, particularly in research, development and innovation, development and innovation in all fields related to computer engineering.
* CG8 - Ability to apply the acquired knowledge and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts, being able to integrate this knowledge.

Basic

* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Depending on the background of the students, more emphasis will be put on discrete-time control (lectures B1-B4), with vision-based control as a particular case, or on, specifically, vision-based control (lectures A1-A4).

Theme content

A1. Introduction to vision-based control
This lecture will provide the fundamentals of digital control (with particular emphasis on vision-based control), as well as on digital image processing and analysis.

A2. Geometry of image formation
This lecture develops the expressions related to the formation of the image in a digital camera, which will be used in T4 when designing the control strategies.

A3. Image features for visual control
This lecture will deal with the computation of the kind of information that is required to be extracted from the available images in a vision-based control framework.

A4. Visual servoing architectures and control design
This lecture will present different approaches for implementing vision-based control, as well as for inferring control laws.

B1. Introduction to discrete-time control systems
This lecture will provide the fundamentals of digital control (with particular emphasis on vision-based control).

B2. Mathematical foundations of control systems
This lecture will introduce the students to the formal tools typically involved in the analysis and design of discrete-time control systems.

B3. Modelling and analysis of discrete-time systems
This lecture will (1) develop models for discrete-time control system and (2) present different tools for discrete-time systems analysis.

B4. Control design and vision-based control
The design of discrete-time controllers will be addressed in this lecture, with particular emphasis on vision-based control.

Teaching methodology

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The theoretical content will be discussed in classroom lectures based on texts by reference to the the student will have access through the library. The theoretical concepts presented will be applied to the troubleshooting / practices , both during the (where appropriate) lectures, and in classes specific problems , or tutoring in small groups or individually .
The student will solve problems / simple practices reinforcement of concepts and techniques seen in class. Also, to deepen these techniques, problems / practices will be proposed complexity slightly higher. The monitoring of the work will be done both in class and through tutorials, Reduced or where an individual level group will proceed to the discussion and exchange of information between student (s) and teacher. This type of activity can be associated oral presentation of work by students.

In order to encourage autonomy and personal work, the subject is part of Campus Extens project. This project incorporates the use of telematic tools to achieve Flexible and distance learning university. In this way, the student will have electronic documents and Internet links related to the content of the subject, statements of problems / practices.

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lectures	Large group (G)	Through the expository method the lecturer will set the theoretical and practical foundations on the different issues enumerated in the course contents. Lectures may alternate theoretical content with problems resolution / laboratory practice.	11
Seminars and workshops	Problems solving	Medium group (M)	Through problems-based learning, students will solve a set of problems / laboratory assignments. The aim is to facilitate the understanding of the theoretical concepts described in class as well as introducing the students to the practical aspects of the subject.	5
Assessment	Assessment 1	Small group (P)	Throughout the semester, students will have to defend the solution given to one or more problems / laboratory assignments. This defense essentially aims at assessing whether the student has understood both the specific aspects of the procedures and techniques described in the classroom, necessary for the resolution of problems / practices.	1
Assessment	Assessment 2	Small group (P)	Throughout the semester, students will have to defend the solution given to one or more problems / laboratory assignments. This defense essentially aims at assessing whether the student has understood both the specific aspects of the procedures and techniques described in the classroom, necessary for the resolution of problems / practices.	1

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

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Modality	Name	Description	Hours
Individual self-study	Self-learning to assimilate lectures contents	Each student will spend some personal time to assimilate theoretical content taught by the teacher in master classes and solve the exercises and proposed problems in teaching units. Some of these problems will be solved by the lecturer or by the students in the classroom.	35
Group or individual self-study	Laboratory exercise(s) 1	Each student will spend some extra time outside of classroom to solve the proposed problems / laboratory assignments. The solution given to those problems / laboratory assignments will be assessed by the lecturer.	11
Group or individual self-study	Laboratory exercise(s) 2	Each student will spend some extra time outside of classroom to solve the proposed problems / laboratory assignments. The solution given to those problems / laboratory assignments will be assessed by the lecturer.	11

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

The subject will be assessed by applying a series of qualification procedures for each activity proposed as evaluable. The table in this section describes, for each activity, the evaluation technique to be applied, the type (recoverable, not recoverable), the qualification criteria, and weight in the overall rating of the subject.

The student will obtain a numerical score between 0 and 10 per assessable activity, which will be adequately weighted in order to obtain the overall rating of the subject.

To pass the course, the student:

(1) Will have to submit to the first set of activities - 'Practice 1' and 'Assessment 1' - and get a minimum score of 4.

(2) Will have to submit to the second set of activities - 'Practice 2' and 'Assessment 2' - and get a minimum score of 4.

(3) The weighted sum of all evaluation activities proposed should result in a minimum 5 points out of 10.

Regarding the recovery period, the student who has not passed any of the two sets of activities can try to recover the activity.

In accordance to the rating of Not Presented mentioned in Chapter IV, Article 34, Item 2 of the Academic Regulations, each student who performs the activities of at least one of the two sets will be considered Presented.

Assessment 1

Modality	Assessment
Technique	Other methods **(retrievable)**
Description	Throughout the semester, students will have to defend the solution given to one or more problems / laboratory assignments. This defense essentially aims at assessing whether the student has understood both

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	the specific aspects of the procedures and techniques described in the classroom, necessary for the resolution of problems / practices.
Assessment criteria	Correct defense of the assignments

Final grade percentage: 20%

Assessment 2

Modality	Assessment
Technique	Other methods **(retrievable)**
Description	Throughout the semester, students will have to defend the solution given to one or more problems / laboratory assignments. This defense essentially aims at assessing whether the student has understood both the specific aspects of the procedures and techniques described in the classroom, necessary for the resolution of problems / practices.
Assessment criteria	Correct defense of the assignments

Final grade percentage: 20%

Laboratory exercise(s) 1

Modality	Group or individual self-study
Technique	Other methods **(retrievable)**
Description	Each student will spend some extra time outside of classroom to solve the proposed problems / laboratory assignments. The solution given to those problems / laboratory assignments will be assessed by the lecturer.
Assessment criteria	Correct, complete, legible solution and report of the assignments

Final grade percentage: 30%

Laboratory exercise(s) 2

Modality	Group or individual self-study
Technique	Other methods **(retrievable)**
Description	Each student will spend some extra time outside of classroom to solve the proposed problems / laboratory assignments. The solution given to those problems / laboratory assignments will be assessed by the lecturer.
Assessment criteria	Correct, complete, legible solution and report of the assignments

Final grade percentage: 30%

Resources, bibliography and additional documentation

Basic bibliography

M. Sam Fadali. Digital control engineering. Academic Press, 2009/2013.
Peter Corke. Robotics, Vision and Control: Fundamental Algorithms in MATLAB; Springer Tracts in Advanced Robotics, 2011.

Date of publication: 25/07/2016