COURSE DESCRIPTION
CONTROL LAB

SSD: AUTOMATICA (ING-INF/04)

DEGREE PROGRAMME: INGEGNERIA DELL'AUTOMAZIONE E ROBOTICA (P38)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None.

PREREQUISITES

Basic knowledge about closed loop control systems; basic knowledge about the typical requirements for
real-time systems.

LEARNING GOALS

The course aims at providing students with the opportunity to get experience on solving practical modeling, identification, and control problems by using the theoretical background of previous courses, for a set of electromechanical applications. Learning will be through the participation to working groups for designing and implementing model-based control laws on a PC and/or on a Microcontroller board and developed for each of the experimental set-ups available in the laboratory, both physical and virtual.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The course provides students the methodology for the design and development of a practical controller by using the principles of Model Based System Design. The student will learn how to apply the concepts of Model in the Loop (MIL), Software in the Loop (SIL), Process in the Loop (PIL) , and Hardware in the Loop (HIL), by following the typical “V” developing scheme, and by taking into account also the definition and testing of the requirements. In each of these steps, the student will have to show of having learned how to apply the theoretical notions of modeling, identification, simulation and control, studied in previous courses, to practical problems and very close to concrete industrial control systems.

Applying knowledge and understanding

The student has to show her/his ability to apply the Model Based System Design methodology to an assigned control system design project. In particular, starting from the development of the laboratory systems simulation models in Matlab/Simulink, the student will deal with the controller design depending on suitable requirements. Then, the student will have to show of knowing how to codify such a control law and how to test it through its implementation on microcontroller boards. The design will be done when the student is able to demonstrate the effectiveness of the developed control logic on the real system, through validation tests.

COURSE CONTENT/SYLLABUS

•Model Based System Design
•“V”-diagram
•Model in the Loop
•Software in the Loop
•Process in the Loop
•Hardware in the Loop
•Specifications Testing and Validation
•Interactive Quanser Virtual Lab
•Servo Motor Control
•Inverted Pendulum
•Aero System
•Interactive Quanser Remote Lab
•Servo Motor Control
•Aero System
•Microcontrollers Programming
•Self-balancing Motorcycle
•Rover
•Drawing Robot
•Temperature Control Lab (Lab on Chip)

READINGS/BIBLIOGRAPHY

Material prepared by the teacher.

TEACHING METHODS OF THE COURSE (OR MODULE)

The teaching activities will be organized as follows: a) lectures for about 20% of the total hours, b) practical experience with the laboratory experimental set-ups for about 80% of the total hours.

EXAMINATION/EVALUATION CRITERIA

b) Evaluation pattern

The exam test consists of discussing a technical report assigned by the teacher and based on one of the available laboratory systems, both physical and virtual. During the test, the student will also have to present the obtained results by means of practical tests on the developed systems.
It will be evaluated the ability to write a technical report, to collaborate in a team project, to present the obtained results. It will be also evaluated the presented project conformance to the required specifications through practical demonstration tests.