Course guide
205256 - IRA - Introduction to Robotics and Automation

Last modified: 02/04/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2024 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Delgado Prieto, Miguel

Others: Flor Sànchez, Marc

TEACHING METHODOLOGY

The course is divided in two parts:

- Theoretical and work group sessions
- Laboratory sessions

Self-study (including proposed exercises and activities) will be also contemplated.

In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results, and illustrate them with appropriate examples to facilitate their understanding. Students, working in groups, will use the new concepts to specify its solution in order to solve the laboratory tasks.
In the lab sessions, teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning.

Students will be able to integrate a robotized and automated solution in order to obtain the complete and correct operation of the system consisting of a robot, a process station and a supervision and control system emulating an industrial task. At lab, students will work in pairs, in order to promote collaborative work and experimental use of the basic tools needed to solve problems.

Students, individually, have to work following the materials provided by teachers in order to assimilate the concepts.

The teachers will provide the syllabus and tasks description trough ATENEA.

LEARNING OBJECTIVES OF THE SUBJECT

This course is based in the practical development of a "hands-on" application of a robotics and automation real case study. The applications must be proposed by lecturers and includes a different set of technologies, all of them often used in industrial environments (e.g. PLCs, OPC, SCADA systems, Industrial Robots, Industrial Communications, Data Bases, etc.).
Applications will be developed by pairs of students, and teachers will assess and supervise each students' teamwork in order to help them in the project development and to solve possible doubts.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	20.00
Self study	45,0	60.00
Hours large group	15,0	20.00

Total learning time: 75 h

CONTENTS

Module 1: ROBOTICS

Description:
* Introduction
* Robot Elements: Drive System, Control System, Sensors, End Effectors,
* Robot Coordinate Systems: Robot coordinate system representation, transformation, homogeneous transform, relating the robot to its world
* Robot Programming: language based programming
* Applications: application of robots to a specific tasks

Related activities:
To develop a Robot program in order to solve the given robotized task

Full-or-part-time: 25h
Theory classes: 5h
Laboratory classes: 5h
Self study : 15h

Module 2: AUTOMATION

Description:
* Automation Fundamentals: Automation and its importance, automation applications, expectations of automation. Types of plant and control (continuous, discrete and mixed processes). Automation hierarchy. Automation Current Trends.
* Programmable Logic Controllers (i.e. PLC): Definition and Architecture. Programming PLCs
* Supervision, Control and Data Acquisition (i.e. SCADA): SCADA Introduction, Elements of SCADA, Features of SCADA, SCADA communications, SCADA development for any one typical application.

Related activities:
To develop a PLC program in order to solve the complete automation of a given production station To develop a SCADA application in order to supervise the complete industrial task.

Full-or-part-time: 25h
Theory classes: 5h
Laboratory classes: 5h
Self study : 15h

Module 3: COMMUNICATIONS AND SYSTEM INTEGRATION

Description:
* LAN Connectivity; Bridges, Routers and Switches
* Solving Distance and Capacity Problems with Full Duplex Ethernet
* Principles of The TCP/IP Architecture
* Features of The Internet Computing Architecture
* Key Elements of The Internet Protocol

Related activities:
To configure an OPC server in order to make possible the complete system integration.

Full-or-part-time: 25h
Theory classes: 5h
Laboratory classes: 5h
Self study : 15h

GRADING SYSTEM

Laboratory test (individually): 20%
Project results (in group): 50%
Small project modification (individually): 30%