COURSE DATA

DATA SUBJECT

Code: 34944
Name: Advanced automation
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1404 - Degree in Industrial Electronic Engineering	Escola Tècnica Superior d'Enginyeria	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1404 - Degree in Industrial Electronic Engineering	Industrial automation and control	COMPULSORY

COORDINATION

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SUMMARY

This course covers advances topics in industrial automation, covered topics go beyond those PLC-based automation systems.

In modern automation systems, it is very common to find different specialized equipment working in integrated manufacturing systems together with PLCs and SCADA systems. As previous courses in the degree covered a wide range of automation principles, this course is focused in the study of automation equipment which is able to perform complex tasks accurately, safely and fast. In most of the cases, this equipment will work side by side with PLC, SCADA, using industrial fieldbuses, etc.

From the wide range of existing equipment, this course will cover in detail those related to industrial robotics, artificial vision systems, and tooling machines as CNC (Computer Numerical Control) or multi-axis systems. The proper knowledge of these systems and the integration in the factory is a key factor in the successful implementation of automation processes.

On the other side, this course will cover the security aspect required in automation. Different regulation

requirements will be discussed so that a proper risk evaluation is done, especially for those related to human safety when working with an automation system. A second security concern is related to explosion-risk ambient (ATEX) as mines, chemical industries, etc. The description of this regulations and the type of devices required to work safely in an ATEX environment will be described.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

In order to successfully follow the course contents, the students should have taken the following courses:
34941 Industrial Automation
34942 Integrated manufacturing systems

COMPETENCES / LEARNING OUTCOMES

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CE10 - Applied knowledge of industrial computing and communications.

CE11 - Ability to design control and automatic industrial systems.

CE7 - Knowledge and capacity for systems modeling and simulation.

CE8 - Knowledge of automatic regulation and control techniques and their application in industrial automation.

CE9 - Knowledge of the basics and applications of robotic systems.

CG3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.

CG4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering (with specific industrial electronics technology).

CG6 - Ability to deal with specifications, regulations and mandatory standards.

DESCRIPTION OF CONTENTS

1. Introduction to advanced automation

General introduction to the course.
What does it mean advanced automation
Automation tasks where the use of specific equipment is required
Special industry environaments: regulations

DURATION: 2 HOURS

2. Industrial robots

Introduction to Robotics. Spatial geometry. Trajectory planification. Industrial robots types.
Robot programming: specific languages and software.
Simulation

DURATION:
10 hours theory (5 sessions)
2 hours problem solving (1 session)
9 hours in laboratory (3 sessions)

3. Computer Numerical Control (CNC)

Computer Numerical Control and other multiaxes control systems.
Hardware components in a CNC
Control and programming for CNC and multiaxes systems.

DURATION:
6 hours theory (5 sessions)
2 hours problem solving (1 session)

4. Artificial Vision

Artificial Vision Systems.
Main components of an artificial vision system: optics, cameras, lighting, etc.
Basic feature extraction in images for indsutrail applications
Basic image processing for industrial applications.

DURATION:
10 hours theory (5 sessions)
4 hours problem solving (2 sessions)
9 hours in laboratory (3 sessions)

5. Regulation and safety in automation systems

CE marking
Machine safety. Risk evaluation
Explosive environments ATEX classified. Equipment selection and installation guidelines for ATEX equipment.

DURATION:
10 hours theory (5 sessions)
4 hours problem solving (2 sessions)
9 hours in laboratory (3 sessions)

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	40,00
Independent study and work	30,00
Preparation of lessons	10,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The teaching methodology will differ according to the teaching unit, the specific topic discussed and the activities proposed in the lecture sessions, both in theory classroom and laboratory.

Specifically, initial **theory lessons** (CE7, CE9, CE10, CE11, CG3) will be taught, supported by a debate proposal to students concerning different practical issues for the topic. After first theory lessons, some **work development** (CE8, CE9, CE11, CG4, CG6) will be proposed to the student to be done outside classroom and further explained in class (some of these tasks will be evaluated). In the problem solving hours students will provide solutions to previously introduced industrial problems. At this point, the active participation of students solving problems, adding new ideas and solutions is very relevant.

Concerning **laboratory sessions** (CE7, CE8, CE9, CE10, CE11), they consist on simulation and hardware

equipment control previously covered in theory classes. Each laboratory session has its own lab guide where all tasks that the student must perform are detailed, the objectives to be achieved and the previous work to be done by the student in order to take the most of the lab sessions.

Lab sessions are evaluated. The criteria is based on achieved goals, active participation and the required reports to be shown to the teacher after the session.

In order to obtain an optimal progress, the student must attend the classes, both theory and laboratory.

EVALUATION

The global evaluation for this course is based on the addition of all different aspects evaluated during the lectures.

At least one personal or group report will be required to hand over along the semester.

The final score will be obtained according to the following formula and applied to all students:

FINAL qualification = (20% individual and group projects handed over during the semester, PACT) + ((20% laboratory exam, ELAB)

Each of the parts score is saved during the semester for obtaining the final value. If some of the exams is failed, a second chance is given.

To calculate the global evaluation is needed to obtain minimum 4.5 mark in both theory and problems exam (ETEO) and laboratory exam (ELAB). On the other hand, the evaluation of individual and group projects (PACT) will be not retrievable.

PACT evaluate outcomes CG6, CE7, CE8, CE9, CE10 i CE11. ETEO evaluate outcomes CG3, CE7, CE8, CE9, i CE11. ELAB evaluate outcomes CG6, CE7, CE8, CE9, CE10, i CE11.

In any case, the evaluation system will be subordinate to the Evaluation and Qualification Regulation of the University of Valencia for Masters and Degrees.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

REFERENCES

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