1. OVERVIEW

Subject area	Project: Robotics, Automation and Smart Systems II
Degree	Bachelor's Degree in Industrial Organisation Engineering
School/Faculty	Faculty of Science, Engineering and Design
Year	2
ECTS	6 ECTS
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	2º

2. INTRODUCTION

This subject forms part of the **Integrated Mechanics, Electronics and Industrial Automation Project** and is one of the **compulsory** parts in the **Degree in Industrial Organisation Engineering syllabus at the Universidad Europea de Valencia**. This subject is one of the traditional guiding principles in the learning process for future engineers who have gained significant knowledge in project management and can apply the skills learnt in the subjects Electrical, Electronic and Automated Engineering and Mechanical and Materials Engineering, together with other subjects such as Skills Development.

Building on this knowledge, this subject aims to provide detailed analysis of those factors worth considering when developing a successful automation project.

During this subject area, students will look at the typical stages of a project, paying particular attention to the **current state of art, the latest scientific technology** and **current legislation and regulations**.

This subject allows students to **analyse, diagnose and solve** possible scientific and engineering issues they may face in the real world and be able to provide answers or propose viable technical or financial alternatives. This involves bringing together all the knowledge learnt on previous courses, as well as a technical introduction which will be taught in the first few sessions.

The subject gives students the platform to gain profound knowledge of **strategical** and **research skills** in parallel.

The Integrated Mechanics, Electronics and Industrial Automation Project is designed to combine **theory and practice** offering students a head start when it comes to dealing with real-life issues, helping them to provide solutions with their skills and knowledge.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- CB1 - Students have shown their **knowledge and understanding** of a study area originating from general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.

- CB2 - Students can **apply their knowledge** to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.
- CB3 - Ability to gather and **interpret relevant data** (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB4 - Students can **communicate information, ideas, problems and solutions** to both specialist and non-specialist audiences.
- CB5 - Students have developed the **learning skills** necessary to undertake further study in a much more independent manner.

Cross-curricular skills (CT, by the acronym in Spanish):

- CT1 - **Ethical values**: ability to think and act in line with universal principles based on the value of a person, contributing to their development and involving commitment to certain social values.
- CT3 - **Teamwork**: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.
- CT4 - **Written/spoken communication**: ability to communicate and gather information, ideas, opinions and viewpoints to understand and be able to act, spoken through words or gestures or written through words and/or graphic elements.
- CT5 - **Analysis and problem-solving:** be able to critically assess information, break down complex situations, identify patterns and consider different alternatives, approaches and perspectives in order to find the best solutions and effective negotiations.
- CT6 - **Adapting to change:** be able to accept, consider and integrate different perspectives, adapting your own approach as required by the situation at hand, and to work effectively in ambiguous situations.
- CT7 - **Leadership**: be able to direct, motivate and guide others by identifying their skills and abilities, in order to effectively manage their development and common interests.
- CT8 - **Entrepreneurial spirit:** ability to take on and carry out activities that generate new opportunities, foresee problems or lead to improvements.

Specific skills (CE, by the acronym in Spanish):

- CE05 - **Ability to use graphic representation techniques and tools**, be they using traditional metric and descriptive geometry methods or computer aided design tools in the field of engineering.
- CE09 - **Ability to use basic theory of circuits** and electronic and electrical technology to solve problems in industrial projects and activity.
- CE10 - **Ability to apply the foundations of automations and control systems** to solve problems in industrial projects and activity.
- CE18 - **Ability to organise, complete and defend a project** in the field of industrial organisation engineering.

Learning outcomes (RA, by the acronym in Spanish):

- RA1: **Carry out a group project** which involves effectively solving problems with the design of mechanical and electronic systems, as well as robotics and automation systems in the Smart Industry.
- RA2: **Gather information** relative to the project field and analyse and synthesise it to understand its field of application.
- RA3: **Plan tasks**, assign responsibility, deadlines and end products.
- RA4: **Hold work meetings** where students use critical thinking to reflect on where they and their colleagues stand. Propose innovative solutions and develop objective arguments which lead to a unified decision-making process.
- RA5: **Adapt to new situations** by reconsidering ideas and reformulating them to reach the final objective in the most suitable way.
- RA6: **Generate a well-structured report** which includes conclusions reached.
- RA7: **Present** the results to a specialised audience.
- RA8: **Defend** the quality of the project before a non-specialised audience using explanatory videos of very short duration.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes (RA, by the acronym in Spanish)
CB: 1, 2, 3, 4, 5 CT: 1, 2, 3, 5, 6 CE: 1, 2, 3, 4	**RA1: Carry out a group project** which involves effectively solving problems with the design of mechanical and electronic systems, as well as robotics and automation systems in the Smart Industry.
CB: 1, 3, 4, 5 CT: 2, 7 CE: 1, 2, 3	**RA2: Gather information** relative to the project field and analyse and synthesise it to understand its field of application.
CB: 1, 3, 4, 5 CT: 2, 3, 5, 6 CE: 1, 4	**RA3: Plan tasks**, assign responsibility, deadlines and end products.
CB: 1, 2, 3, 4 CT: 1, 3, 4, 6 CE: 1, 5, 7, 8	**RA4: Hold work meetings** where students use critical thinking to reflect on where they and their colleagues stand. Propose innovative solutions and develop objective arguments which lead to a unified decision-making process.
CB: 1, 2, 3, 5 CT: 1, 5, 6, 7 CE: 1, 2, 3, 4	**RA5: Adapt to new situations** by reconsidering ideas and reformulating them to reach the final objective in the most suitable way.
CB: 2, 3, 5 CT: 3, 4, 5, 7 CE: 1, 2, 3, 4	**RA6: Generate a well-structured report** which includes conclusions reached.
CB: 1, 4 CT: 2, 3, 7 CE: 2	**RA7: Present the results** to a specialised audience.
CB: 1, 4 CT: 1, 3, 6, 7 CE: 2	**RA8: Defend the quality of the project** before a non-specialised audience using explanatory videos of very short duration.

4. CONTENTS

This subject is organised into topics, inspirational and practical sessions, so that students can immerse themselves in the theory and apply their knowledge in practical sessions through inspirational classes:

Semester II
Topic 1 - Mechanical and electronic systems design
Topic 2 - Robotics systems design and control
Topic 3 - OEE
Topic 4 - Line capacity and SMED methodology
Topic 5 - Automation in the smart industry
Topic 6 - KPIs in production lines
Topic 7 - Simulation
Topic 8 - Agile methodologies

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- **Theory sessions (master lectures):** Introduction to the core concepts for the integration and development of the project.
    - The theory sessions are organised into subject matters including knowledge areas and project-related work.
        - The knowledge areas will be taught in order.
        - The project-related sessions will be held depending on the project evolution.
- **Project-based collaborative learning (practical classes and problem solving):** Practical sessions on projects and solutions to implement, clarify or debate using theory knowledge.
- **Gamification through case-study:** setting challenges which give students experience of real situations which are hard to resolve, offering the chance to discuss different approaches and conclusions students reach as a group.
- **Project progress and management sessions:** Each group will try to advance their project during the session, holding group meetings, proposing alternative strategies and assigning work and responsibility. Each group will also present the project status at defined points, and progress will be discussed together with the next steps to take. (assessed)
- **Field work:** Field trips to prestigious companies for work experience, carried out both on campus and in the workplace.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

Learning activity	Number of hours
Master classes	12.5
Problem-solving	3.5
Case studies and field studies	4
Integration projects	70
Debates and discussions	8
Learning contract (definition of interests, needs and objectives)	2
Independent working	35.5
Tutorials	12.5
Knowledge tests	2
TOTAL	**150**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

Subject Assessment Criteria (SEA by the acronym in Spanish)	Weighting
SEA1. Attitude assessment tests: - Class participation. - Assessed individually. - Participation, interest and preparation prior to class will all be taken into consideration.	10%
SEA2. Self- and co-assessment: - Assessment by lecturer: interest, attitude, active participation - Peer reviews - Self-assessment questionnaires	20%
SEA3. Project journals - Individual work: We will assess understanding of theory, how technical proposals are articulated, technical feasibility of ideas, as well as financial analysis. - Group work: We will assess the structure and content of the journal, language used, whether it is simple and direct, emphasis on key elements and solutions, how reasoning is justified clearly and graphically, and how the development, solution and implementation have been documented.	40%
SEA4. Presentation and defence of projects - Group work: We will assess the total group participation, clear and easy-to-follow presentation, defence and reasoning of decisions regarding project design and the solutions provided to the issues at hand.	30%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

8. BIBLIOGRAPHY

The reference publication to accompany this subject area is:

- Introducción a la Automatización Industrial – Mayo 2021 – Alberto Brunete, Pablo San Segundo y Rebeca Herrero
- Integración de sistemas de automatización industrial - JUAN MANUEL ESCAÑO GONZÁLEZ, ANTONIO NUEVO GARCIA, JAVIER GARCÍA CABALLERO

The recommended bibliography is indicated below:

- KALPAKJIAN, Serope. Manufactura, Ingeniería y tecnología. Pearson Educación, 2002. 1176p. ISBN 970-26-0137-1
- CAPUZ, Salvador. Introducción al proceso de producción Ingeniería concurrente para el diseño de producto. Alfaomega, 2001. 218 p. ISBN 979-15-0664-2