



Universidad de Jaén

School of Engineering of Jaén

Advanced Automation

2024-2025

Grado en Ingeniería de organización industrial (E.P.S. Jaén)

Doble Grado en Ingeniería mecánica e Ingeniería de organización industrial (E.P.S. Jaén)



CREA



- Acceso Mayores 40
- Guías docentes UJA
- Horarios de tutorías
- Llamamientos PAU
- Movilidad (Coordinador)
- P.O.D.
- Solicitud bilingüismo

Syllabus 2024-25 - 13013002 - Advanced Automation (Automática avanzada)

Caption

- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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DEGREE: Grado en Ingeniería de organización industrial (13013002)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Doble grado en Ingeniería mecánica e Ingeniería de organización industrial (13813020)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
ACADEMIC YEAR: 2024-25
COURSE: Advanced Automation

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Advanced Automation
CODE: 13013002 (*)
LANGUAGE: English
ECTS CREDITS: 6.0
ACADEMIC YEAR: 2024-25
LEVEL: 1
YEAR: 4
SEMESTER: SC

2. LECTURER BASIC INFORMATION

NAME: GONZÁLEZ RODRÍGUEZ, ÁNGEL GASPAR
DEPARTMENT: U133 - ING. ELECTRÓNICA Y AUTOMÁTICA
FIELD OF STUDY: 520 - INGENIERÍA DE SISTEMAS Y AUTOMÁTICA
OFFICE NO.: A3 - 442
E-MAIL: agaspar@ujaen.es
P: 953212457
WEBSITE: www4.ujaen.es/~agaspar
ORCID: <https://orcid.org/0000-0002-7461-9135>
LANGUAGE: -
LEVEL: 1

3. CONTENT DESCRIPTION

Theory

Thematic Blocks

- Graphical User Interface (GUI) and SCADA Systems.
- Industrial communications
- PLC. Programming in KOP language.
- Introduction to Industrial Robotics. Basic configurations and programming.

1. Graphical User Interface and SCADA Systems

Traditional user interface devices.

Displays and touch panels.

Definition of a SCADA System.

2. Industrial communications

Basic concepts and motivation

Physical and link level

Profinet and AS-i bus

3. Programmable automata. Programming in KOP language.

Reminder of programmed automations.

Types of languages for programmable controllers

Features of the Siemens S7-1200 PLC.

Programming Programmable Automata with Grafcet.

Components of a Grafcet according to standard 60848

Translation into KOP language of the basic Grafcet structures.

Shared resources.

Emergency starts and stops

4. Introduction to Industrial Robotics. Basic configurations and programming.

Main configurations of industrial robots.

Programming a FANUC industrial robot. Practical examples.

Synchronization between robots. Cooperating robots.

Practical classes

The practical classes will be carried out weekly, in groups of two people, and will last two hours.

Prior to the practice, a script will be provided with an exercise that the student must do. Throughout the two hours of practice, the exercise will be completed and tested, checking its operation.

The following practices are planned.

Electrical and electro-pneumatic automation with wired logic

Design of a Man-Machine interface for the operation of an electro-pneumatic automation.

Profinet Network Configuration

Programmable PLC programming in LAD language for the control of a pneumatic automation. Function blocks

Control of a parts assembly station 1

Control of a parts assembly station 2

Control of a parts assembly station 3

Control of a parts assembly station 4

Management of a Fanuc industrial robot. Design of a simple manipulation program

Roboguide robot programming software. Basic program with 6 DOF robot

Management of a Fanuc industrial robot. Manipulation program design II.

Roboguide robot programming software. Synchronization between robots
Coordination between robots and with conveyor

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

Expository classes in large groups and practices to be carried out during the semester where all the concepts acquired during the master classes will be applied.

The practices will be carried out weekly and in most of them the group of students will be asked to provide a programmed solution to the problem posed in the practice script.

In the expository classes, both theory and problems will be taught, limiting the theoretical content to what is strictly necessary to contextualize the problems and provide the basis with which to understand them. The problems will deal with real situations and will show the programming of the hardware devices analyzed in the thematic block: robots and programmable automata.

This is intended to cover the skills: M1 Expository classes in large groups: Master classes; M2 Lectures in large groups: Presentation of theory and general examples; M3 Expository classes in large groups: Introductory activities. Also transversal skills: CT1 - Ability to work, direct and manage conflicts in a multidisciplinary group and/or in a multilingual environment; CT2 - Capacity for information management, handling and application of technical specifications and legislation necessary for engineering practice; CT3 - Entrepreneurship capacity and entrepreneurial culture; CT4 - Ability to apply new technologies including information and communication technologies; CT5 - Respect for human rights and those who suffer from disabilities and willingness to eliminate discriminatory factors with gender, origin, etc.; CT6 - Capacity for oral and written transmission of information adapted to the audience. Also the basic competence CB2 - That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

The acquisition of these basic and general skills are reinforced in the practice sessions.

In April it is planned to bring a speaker from a leading Automation company who will discuss trends at the forefront of the industrial field.

The proper use of the practices will allow the acquisition of the skills M11-Classes in small group: Solving exercises, M6-Classes in small group: Practical activities and M8-Classes in small group: Debates

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

5. ASSESSMENT METHODOLOGY

The grade for the subject will be given by the grade obtained in practices, which is evaluated up to 9 points, to which are added the grades obtained in attendance/participation and in the preparation of voluntary work. Since attendance is mandatory, the grade added for the concept of attendance and participation may be negative if there are lacks of attendance.

Regarding voluntary exercise, the overscore will always be positive, up to a value of two points.

In this way, the grades that can be obtained in each concept are:

- Practices. Between 5 points and 9 points. Below 5 points, the subject is considered failed. If two or more practices are not completed, the subject is also considered failed.
- Assistance and participation at class. Between -1 point and +1 point to add to the practice grade. For students who have attended all classes, but have not participated in them, the score will be 0 points.
- Carrying out voluntary work. Between 0 and 2 points to add to the practice (and attendance) grade.

Voluntary exercises

Voluntary exercises may be done in groups of two (except in the case of work on As-I bus, which may be 3). The extra score obtained will depend on the degree of complexity, depth and precision of the work carried out.

The work to be done is listed below. Based on the proposed base, students will be able to expand the work with new functionalities/options. The proposed works are:

1. Design and assembly of electropneumatic circuits
2. Study of new functionalities of the Fanuc robot controller software.
3. Creation of an As-I network.
4. PLC control of an induction motor fed by a frequency converter. Incorporation of a Siemens encoder.
5. PLC control of a stepper motor powered by a Siemens controller card.

As a general rule, achieving the main objective with adequate accuracy will result in a grade of +1 point (except in assignment 3). A higher grade (up to +2 points) will be achieved depending on the additional contribution to the work.

These criteria are intended to evaluate the learning results 42, 43, 44, 45, COPT2R, COPT3R and COPT4R, within the CB2R competence and in a transversal way, also the CT1, CT2, and CT4 competences. In case of submitting voluntary work, CT6 competence will also be evaluated.

Specifically:

learning outcomes 42, 44 and 45 would be evaluated with laboratory practices

result 43 would be evaluated through questions during the master classes.

The COPT2R, COPT3R and COPT4R learning results would be evaluated through questions during the master classes, and with laboratory practices.

6. BOOKLIST [\(Access the bibliography in the Library catalog\)](#)

MAIN BOOKLIST:

- PLC and HMI development with Siemens TIA Portal : develop PLC and HMI programs using standard methods and structured approaches with TIA Portal V17 . Edition: -. Author: Bee, Liam, author.. Publisher: Packt Publishing [\(Library\)](#)

7. SUSTAINABLE DEVELOPMENT GOALS

Energía asequible y no contaminante

Industria, innovación e infraestructura

DETAILED INFORMATION

7.3 By 2030, double the global rate of improvement in energy efficiency.

7.a By 2030, increase international cooperation to facilitate access to clean energy research and technology, including renewable sources, energy efficiency and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean technologies.

9.1 Develop reliable, sustainable, resilient and quality infrastructure, including regional and cross-border infrastructure, to support economic development and human well-being, with special emphasis on affordable and equitable access for all.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

For training activities A1 - Large group expository classes, a 100% face-to-face format is established *

For training activities A2 - Expository classes in small groups, a 100% face-to-face format is established **

Tutorials will preferably be carried out in person, in office A3.442.

(*) The Center may establish a different percentage of presence depending on the number of students and classroom/laboratory capacity.

(**) The Center may establish rotating presence depending on the number of students and classroom/laboratory capacity (class on schedule and classroom/laboratory assigned to part of the group and retransmission by videoconference to the rest, with periodic rotation of students, according to determine the Center).

The evaluation system will be the same as that established for the in-person scenario.

9. VIRTUAL TEACHING SCENARIO

In the case of a non-face-to-face scenario, students will be provided with FANUC robot simulators and the CODESYS program so that they can carry out simulation practices.

The PLC programming practices, to be carried out with TIA Portal, will be adapted to the possibilities of remote access to the PCs of the A3-485 laboratory. If possible, said PCs will be used remotely in conjunction with pneumatic drive and motor control racks.

If it is not possible to access said program, CODESYS will be used for automaton practices. In that case, students will send the code of the program that solves the exercise proposed in each practice and/or a video demonstrating its operation.

The evaluation will follow the same guidelines and weights as in the in-person scenario with the following distinctive details:

The evaluation of attendance and interventions will be carried out in online classes

The performance of voluntary work will be limited to theoretical or simulation work.

The evaluation of the practices will not have the correction component prior to the practice, but the sending of a video demonstrating the proper functioning of the code used may be requested. As in the face-to-face scenario, it will be the continuous evaluation of practices that will carry the greatest weight in the grading of the subject.

DATA PROTECTION CLAUSE (on line exams)

Institution in charge of data processing: Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

Data Protection Delegate: dpo@ujaen.es

Purpose: In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

Legitimacy: compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

Addressees: service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

Storage periods: those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

Rights: you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection www.ctpdandalucia.es

CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

Person in charge: Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; www.ujaen.es

Data protection delegate (DPO): TELEFÓNICA, S.A.U. ; Email: dpo@ujaen.es

Procedure aim: To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

Period for record storage: Images will be kept during legal term according to regulations in force

Legitimacy: Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

Data recipients (transfers or assignments): Any person allowed to get access to every teaching modality

Rights: You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council www.ctpdandalucia.es

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