

**COURSE DATA****DATA SUBJECT****Code:** 34942**Name:** Integrated manufacturing systems**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	3	Second quarter

SUBJECT-MATTER

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

COORDINATION

AMOROS LOPEZ JULIA CARMEN

GOMEZ SANCHIS JUAN

SUMMARY

Integrated Manufacturing Systems is a four-month course that is taught in the second semester of the third year of the Degree in Industrial Electronics Engineering. The course is framed in the block "automation and industrial control". The course has a teaching load of 6 ECTS credits.

During the course we review the concept CIM (Computer Integrated Manufacturing), and the tools and knowledge available to the engineer to carry out implementations based on the use of industrial distributed systems. We will show the concept of standard and will present the main global standardization organizations. In this context, ISO/OSI communication model will be shown.

A vital element in any integrated manufacturing system are industrial communication buses. During the course we will show industrial communication buses classified by the level of hierarchy in the automation pyramid. Communication system must be integrated into systems called SCADA. This kind of systems can be used for supervising and controlling the industrial processes by the management department. A review of the main features of SCADA and HMI systems will be done. In recent years systems based on industrial PCs have experienced a boom in automation systems for complex



tasks. Thus, it is necessary to describe the main technologies related to the use of industrial PCs. Finally, knowing all the aspects involved in the integrated manufacturing systems, design methodologies of this kind of systems will be discussed.

The course is divided into blocks of content. The blocks and their contents are as follows:

BLOCK I. Communication systems in industrial processes.

Introduction to integrated manufacturing systems.

Network topology and logical structure.

Industrial communication networks.

BLOCK II. Supervisory and control systems.

Supervisory and control systems.

Industrial PCs.

BLOCK III. Industrial processes and pneumatic systems.

Industrial processes based on distributed automation using PLC.

Introduction to pneumatic automation.

BLOCK IV. Integrated manufacturing systems laboratory.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

It is highly recommended to have attended previous courses related to industrial automation.

COMPETENCES / LEARNING OUTCOMES

1404 - Degree in Industrial Electronic Engineering



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.

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. Communication Systems in Industrial Processes

Introduction to integrated manufacturing systems.

- 1.1. CIM concept (Computer Integrated Manufacturing).
- 1.2. Industrial control systems. Centralized vs Distributed control strategies.
- 1.3. Communication hierarchy: Automation pyramid.
- 1.4. Standardized systems.

Network topology, links and logical structure.

- 2.1. Industrial local networks. ISO/OSI Model.
- 2.2. Network topology.
- 2.3. Medium access control.
- 2.4. Transmission media.

Industrial communication networks.

- 3.1. Basic communication standards.
- 3.2. Industrial networks. Types according to automation level.
- 3.3. Sensor-actuator buses. ASi.
- 3.4. Device-oriented buses. CAN Bus and MODBUS.
- 3.5. Field buses. Profibus.
- 3.6. Unification of automation levels. Profinet and Modbus TCP.

Industrial processes based on distributed control with PLC.

- 4.1. Processes and tasks assignable to a PLC.
- 4.2. Distributed model of automation systems.
- 4.3. Selection of communication systems between PLCs.
- 4.4. Selection of communication systems with field devices. Decentralized peripheral.



2. Supervision and Control Systems

Systems for production, supervision and control.

- 5.1. Introduction to SCADA systems.
- 5.2. Architecture of a SCADA system.
- 5.3. Modules of a SCADA system .
- 5.4. Dinamic information exchange. OPC.
- 5.5 Human-Machine Interfaces (HMI).

Industrial PCs.

- 6.1. Industrial PCs vs PLCs. Advantages and drawbacks.
- 6.2. Characteristics of an industrial PC.
- 6.3. Peripherals of an industrial PC.
- 6.4. Systems based on industrial PCs.
- 6.5. Operating systems.

3. Industrial Processes and Pneumatic Systems

Pneumatic systems.

- 7.1. Pneumatic systems in industrial automation.
- 7.2. Compressed air theory.
- 7.3. Air treatment.
- 7.4. Directional valves.
- 7.5. Regulating and control valves.
- 7.6. Linear actuators.
- 7.7. Rotary actuators.

4. Integrated Manufacturing Systems Laboratory

A project titled "Parts Classification System" will be carried out with the following practical sessions:

Practice 1. Introduction to Schneider Modicon 340 PLCs (master and slave PLCs).

Practice 2. Parts classification system using a rotary machine (slave PLC).

Practice 3. Configuration of communications between PLCs (master and slave PLCs).

Practice 4. Conveyor belt control using a variable frequency drive (master PLC).

Practices 5 and 6. Design and interaction with the process using an HMI screen (master PLC, Schneider Magelis screen).

Individual exam.



WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	25,00
Laboratory	20,00
Classroom practices	15,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	25,00
Independent study and work	10,00
Preparation of lessons	30,00
Preparation for assessment activities	25,00
Resolution of case studies	0,00
Total hours	90,00

TEACHING METHODOLOGY

The methodology is structured around the theory, problems and laboratory sessions that will be evaluated during the course. As teaching methodology for lessons of theory and practice, "lecture" will be used as a teaching model. In particular, in the practice sessions, the teacher will conduct a series of example problems and after this they will solve similar problems in the area of the proposed work. Additionally, the student will carry out a project in groups of 2-4 students using a Siemens PLC.

These activities will be guided by the lecturer through tutorial classes to verify the proper development of the student during the course.

The labs are divided into lab groups consisting of pairs of students to promote social skills of teamwork and mutual participation. Students should prepare the laboratory sessions at home by reading the educational material prepared for this purpose. A series of questionnaires will be answered by the students in order to verify the minimum knowledge required for a successful implementation.

Occasionally, depending on the planning and availability, seminars will be organized by industry experts on a specific topic. These seminars will be developed in class or in the industrial environment, so that the student knows in first person the real working environment and specific technologies implemented in a real environment.

The proposed methodology and activities will encourage the development of all the skills specified for this course (CG3, CG4, CG6, CE7, CE10, CE11).

EVALUATION



The evaluation will be conducted during the entire course, evaluating theory, practice and laboratory sessions in order to have global idea of knowledge and skills of the student.

a) Theory:

A theoretical written exam will be done by the student. This test will be done in date and time indicated in the official ETSE agenda (web information available). Additionally, a midterm exam and some exercises will be proposed during the subject.

b) Practice:

The student will perform one practice case or project that will be proposed by the teacher in line with specific educational needs of the student.

c) Laboratory:

A continuous evaluation of each session together with a laboratory exam will evaluate the skills achieved during the course by the student.

It will be necessary that the student will get a score of 5 at least in each part (theory, practice and laboratory) in order to pass de course.

The global score will be obtained using the next formula:

$$\text{Global_Score} = (\text{Theory_Score} + \text{Practice_Score} + \text{Laboratory_Score}) / 3$$

In any case, the system of evaluation will be ruled by the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Master's degree

(<https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639>)

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



- "Autómatas Programables", J. Balcells, J. L. Romeral. Marcombo. 1997. ISBN: 84-267-1089-1.
- "Autómatas Programables. Entorno y Aplicaciones". E. Mandado, J. Marcos, etc. Thomson / Paraninfo. 2005.
- "Autómatas Programables", A. Simon. Paraninfo. 1995. ISBN: 84-283-1578-7.
- "Automation production systems and computer integrated manufacturing". Groover, M.P., Prentice Hall. ISBN 0-13-088978-4
- "Computer Integrated Manufacturing". Regh, J.A., Kraebber, H.W. Prentice Hall, ISBN 0-13-087553-8
- "Automating with SIMATIC S7-1500": Configuring, Programming and Testing with STEP 7 Professional". Berger, Hans. Erlangen: Publicis Publishing, 2014.
- "Fieldbus and Networking in Process Automation". Sunit Kumar Sen. CRC Press, 2014 (Print ISBN-13: 978-1-4665-8676-5, Web ISBN-13: 978-1-4665-8677-2). Libro electrónico disponible online en la biblioteca de la UV.



- "Advanced Industrial Control Technology". Peng Zhang. Publisher: William Andrew. 2010. (Print ISBN-13: 978-1-4377-7807-6, Web ISBN-13: 978-1-4377-7808-3). Libro electrónico disponible online en la biblioteca de la UV.