UAB
Universitat Autònoma de Barcelona

Smart Industry

Code: 44736
ECTS Credits: 6

2025/2026

Degree	Type	Year
Research and Innovation in Computer based Science and Engineering	OP	1

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is recommended that the student have knowledge of signal theory, differential equations and linear systems.

Objectives and Contextualisation

The objective of the course is to provide the student with fundamental knowledge in the application of the Internet of things, control systems and data processing in Industry 4.0.

Learning Outcomes

1. CA16 (Competence) Propose viable projects and actions based on Smart Industry systems that enhance social, economic and environmental benefits.
2. CA17 (Competence) Design innovative applications in the fields of science and engineering by applying theoretical models and the techniques and tools used in Smart Industry.
3. KA21 (Knowledge) Identify the key elements of the Connected Industry (information, connectivity, intelligent production) and of Industrial Big Data systems (data collection and processing, extraction of patterns and predictive systems, data analytics and decision-making).

4. KA22 (Knowledge) Identify the best technologies for each industrial Internet of Things (IIoT) environment (sensing, processing, communication, actuation) as well as for the realisation of industrial control systems through architectures, communication systems, monitoring and supervision, and advanced control systems.
5. SA27 (Skill) Solve problems requiring industrial automation and control by monitoring networks using specific concepts and technologies.
6. SA28 (Skill) Analyse the value chain of industrial data to improve prediction and decision-making systems in Smart Industry.
7. SA29 (Skill) Assess the requirements of industrial systems in terms of communications and energy efficiency, and develop solutions that fulfil them.
8. SA30 (Skill) Integrate industrial cybersecurity (alert levels, SCADA systems, risk analysis, protection, blockchain technologies) in critical infrastructures and industrial automation systems.

Content

This course deeps into sensorization, connectivity, data analysis and use cases for the improvement of production processes and maintenance. Enabling technologies will be analyzed, such as the concept of the Industrial Internet of Things IIOT, energy harvesting technologies, advanced control mechanisms, data-driven decision-making, quality control techniques, and the circular economy.

Block 1. Connected Industry (MiSE)

- Elements: Industry 4.0, Industrial Internet of Things (IIoT), Cyber-Physical Systems.
- Connectivity, Information.
- Intelligent Manufacturing.
- Digital Twins and COBOTS.
- Industrial Internet of Things.
- Energy Harvesting.
- Enabling Technologies and Sensors.
- Wired and Wireless Industrial Buses/Protocols.
- IIoT Communication Standards (OPC-UA, MQTT, etc.).
- Cybersecurity in IoT.

Block 2. Industrial Big Data (TES-Wireless)

- Big Data Architectures and Platforms for Industry 4.0
- Types of Data Storage.
- Data Processing Engineering and Artificial Intelligence
- Data Visualization in Industry 4.0.

Block 3. Industrial Control Systems (TES-ESA)

- Feedback Control Systems
- Dynamic Analysis of Linear Systems
- Frequency Analysis of Linear Systems
- PID Controller Design

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises and laboratories	24	0.96	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30, CA16

Laboratory activities	76	3.04	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30, CA16
Theory classes	26	1.04	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30, CA16

The teaching methodology to be followed is oriented towards the continued learning of the subject by the student. This process is based on the realization of three types of activities that will be developed throughout the course: theory classes, problem seminars and project development.

• Theory sessions: the professor will explain the fundamental contents of the subject and the strategies to acquire, expand and organize this knowledge. Participation will be encouraged by student activity through exercises and the use of interactive tools for student participation.

• Problem seminars: students will have to participate actively to consolidate the knowledge acquired by solving, presenting, and debating related problems.

- Laboratory sessions. The student will carry out laboratory sessions by computer to become familiar with the contents of the theoretical classes.
- Project development: students will have to complete several projects to put together the techniques introduced in the course.

The platform to communicate with students is Moodle.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Project block #1	50%	12	0.48	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30
Project block #2	25%	6	0.24	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30
Project block #3	25%	6	0.24	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30

The evaluation of the subject will be done progressively and continuously throughout the semester. The evaluation system is based on the following rules:

a) Scheduled evaluation process and activities

The following activities are planned:

- Activity A. Develop a project corresponding to Block 1.

  The project involves designing an IoT product from its concept to realization using commercial platforms. Students are divided into teams that work on different parts of an IoT project: (i) use case, sensors, and communication; (ii) cloud platforms; (iii) HW device. This activity accounts for 50% of the total grade for the course.

  Activity B. Develop a project corresponding to Block 2.

The project involves creating a monitoring system for a solar energy production plant. Three subsystems will be created to ensure correct operation: (i) the photovoltaic plant simulator with Python, (ii) the data capture and storage system (Python + InfluxDB), (iii) the data visualization system (Grafana). This activity accounts for 25% of the total grade for the course.

Activity C. Develop a project corresponding to Block 3.

The project focuses on designing a PID controller for a system provided by the professor. The system will be represented in Simulink, and a PID controller will be designed to meet given specifications. The design will be tested through simulation, and a sensitivity analysis will be conducted. This activity accounts for 25% of the total grade for the course.

The final grade is calculated as the weighted average of the grades of each activity, according to the percentages stated before, where each grade is in the range from 0 to 10. To pass the subject (passing means obtaining at least a 5 in the final grade), you will need to obtain a minimum grade of4 in all the activities. Activities are not recoverable, in the sense that they must be handed out to professors and passed as indicated in the continued evaluation. If a 4 is not obtained in any of the parts, the final grade will be the average of the notes of the blocks if it is less than 4 or 4 if it is higher.

b) Programming of evaluation activities

The calendarization of the assessment activities will be shown onthe first day of the subject.

c) Recovery process

Activities are not recoverable. All of them must be completed along the course.

d) Qualification review procedure

For each assessment activity, a review place, date and time will be indicated in which the student can review the activity with the professor. In this context, claims can be made about the grade of the activity, which will be evaluated by the teaching staff responsible for the subject. If the student does not appear for this review within the set deadlines, this activity will not be reviewed later.

e) Qualifications

The final grade of the subject will be calculated according to those mentioned in item a) of this Section. It should be noted that:

• Honorous grade ("MH"). Awarding an honors excellent grade is solely the decision of the faculty responsible for the subject. UAB regulations indicate that MH can only be granted to students who have obtained a final grade equal to or higher than 9.00 and in an amount not exceeding 5% of the number of students in the subject.

• Not assessable. A student who has not taken any activity will be considered "not assessable". In any other case, the assessment criteria detailed above are followed.

f) Irregularities by the student, copying and plagiarism

Without prejudice to other disciplinary measures that are considered appropriate, irregularities committed by the student that could lead to a variation in the grade of an assessment act will be graded with a zero. Therefore, copying, plagiarism, cheating, allowing copying, etc. in any of the evaluation activities will involve suspending it with a zero. If it is necessary to pass any of these assessment activities to pass the subject, this subject will be suspended directly, withno opportunity to recover it in the same course.

g) Evaluation of repeating students

For repeating students, none of the activity grades are saved from one course to the next. Repeat students follow the same assessment rules as any other student.

Bibliography

Block 1.

- Rajeev Alur "Principles of Cyber-Physical Systems", The MIT Press, 2015
- Alasdair Gilchrist "Industry 4.0. The Industrial Internet of Things", Springer, 2016.

Block 2.

- Masoud Soroush, Michael Baldea, Thomas Edgar (Eds), Smart Manufacturing, Springer, 2020
- Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016

Block 3.

- C. Phillips, J. Parr, Feedback control systems, Pearson 2011.
- P. J. Antsaklis, A. N. Michael, *Linear Systems*, Birkhauser-verlag, 2006.
- H. K. Khalil, *Nonlinear systems*, Pearson 2001.
- J.J. Slotine and W. Li, *Applied nonlinear control*, Pearson 1991.

Software

The software employed will be Python and Matlab/Simulink.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLABm) Practical laboratories (master)	1	English	second semester	afternoon
(TEm) Theory (master)	1	English	second semester	afternoon