UAB Universitat Autònoma de Barcelona	Smart Industry Code: 44736 Credits: 6	2026/2027

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

Contact lecturer

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Group languages

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

Prerequisites

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

Objectives

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

- CA16 (Propose viable projects and actions based on Smart Industry systems that enhance social, economic and environmental benefits.) Propose viable projects and actions based on Smart Industry systems that enhance social, economic and environmental benefits.
- CA17 (Design innovative applications in the fields of science and engineering by applying theoretical models and the techniques and tools used in Smart Industry.) Design innovative applications in the fields of science and engineering by applying theoretical models and the techniques and tools used in Smart Industry.
- KA21 (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).) 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).

- KA22 (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.) 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.
- SA27 (Solve problems requiring industrial automation and control by monitoring networks using specific concepts and technologies.) Solve problems requiring industrial automation and control by monitoring networks using specific concepts and technologies.
- SA28 (Analyse the value chain of industrial data to improve prediction and decision-making systems in Smart Industry.) Analyse the value chain of industrial data to improve prediction and decision-making systems in Smart Industry.
- SA29 (Assess the requirements of industrial systems in terms of communications and energy efficiency, and develop solutions that fulfil them.) Assess the requirements of industrial systems in terms of communications and energy efficiency, and develop solutions that fulfil them.
- SA30 (Integrate industrial cybersecurity (alert levels, SCADA systems, risk analysis, protection, blockchain technologies) in critical infrastructures and industrial automation systems.) Integrate industrial cybersecurity (alert levels, SCADA systems, risk analysis, protection, blockchain technologies) in critical infrastructures and industrial automation systems.

Contents

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

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Exercises and laboratories	24	0.96	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30
Theory classes	26	1.04	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30
Laboratory activities	76	3.04	CA16, CA17, KA21, KA22, SA27, SA28, SA29, SA30

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

Continuous assessment activities

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

a) Assessment Activities

The following assessment activities are planned:

Activity A. Develop a project corresponding to Block 1. The project consists of designing an IoT product from concept to implementation using commercial platforms. Students will work in teams covering the different components of an IoT project: (i) use case, sensing and communications; (ii) cloud platforms; and (iii) hardware device. This activity accounts for 50% of the final course grade.

Activity B. Develop a project corresponding to Block 2. The project consists of developing a monitoring system for a solar power generation plant. Three subsystems will be implemented to ensure the correct operation of the system: (i) a photovoltaic plant simulator developed in Python; (ii) a data acquisition and storage system (Python + InfluxDB); and (iii) a data visualization system (Grafana). This activity accounts for 25% of the final course grade.

Activity C. Develop a project corresponding to Block 3. The project focuses on the design of a PID controller for a system provided by the instructor. The system will be modeled in Simulink, and a PID controller will be designed to meet a given set of performance specifications. The design will be validated through simulation, and a sensitivity analysis will be carried out. This activity accounts for 25% of the final course grade.

The final grade is calculated as the weighted average of the grades obtained in each activity, according to the percentages indicated above, where each activity is graded on a scale from 0 to 10.

To pass the course (i.e., obtain a final grade of at least 5.0), students must obtain a minimum grade of 4.0 in each assessment activity.

The assessment activities are not resubmittable. They must be submitted and passed as part of the continuous assessment process. If a student obtains less than 4.0 in any activity, the final grade will be the weighted average if it is below 4.0, or 4.0 if the weighted average is higher.

b) Assessment Schedule

The schedule of assessment activities will be announced on the first day of the course.

c) Resit Process

Assessment activities are not eligible for resit.

All assessment activities must be completed during the semester.

d) Grade Review Procedure

For each assessment activity, the date, time, and location of the review session will be announced. During this session, students may review their work with the instructor and submit any requests for grade reconsideration. Such requests will be evaluated by the instructors responsible for the course. Students who do not attend the review session within the established period will not be entitled to a subsequent review of that assessment.

e) Final Grades

The final course grade will be calculated according to the criteria described in Section (a).

Special grading categories include:

Honours Distinction ("MH")

The awarding of an Honours Distinction is at the sole discretion of the course instructors. According to UAB regulations, this distinction may only be awarded to students with a final grade of 9.0 or higher, and to no more than 5% of the students enrolled in the course.

Not Assessed ("NA")

Students who do not participate in any assessment activity will receive a grade of Not Assessed (NA). In all other cases, the grading criteria described above will apply.

f) Academic Misconduct, Copying and Plagiarism

Without prejudice to any additional disciplinary measures that may be deemed appropriate, any academic misconduct committed by a student that may affect the assessment of an activity will result in a grade of 0 for that activity. This includes, but is not limited to, copying, plagiarism, cheating, facilitating cheating, or any other form of academic dishonesty.

If passing the failed assessment activity is required to pass the course, the student will automatically fail the course, with no possibility of resitting it during the same academic year.

g) Assessment of Repeat Students

For students repeating the course, no grades from previous academic years will be retained. Repeat students are subject to the same assessment regulations as all other students.

h) Use of Artificial Intelligence (AI)

The use of Artificial Intelligence (AI) technologies is permitted as part of the development of coursework, provided that the final submission reflects a substantial personal contribution by the student in terms of analysis and critical reflection.

Students must clearly identify which parts of their work have been generated using AI, specify the tools used, and include a critical reflection on how these tools influenced both the development process and the final outcome.

Failure to disclose the use of AI will be considered a breach of academic integrity and may result in a reduction of the grade for the assessment activity or more severe disciplinary sanctions in serious cases.

Without prejudice to any additional disciplinary measures established by the applicable academic regulations, any assessment activity affected by academic misconduct that compromises the integrity of the evaluation process will receive a grade of 0. Assessment activities graded in this way are not eligible for reassessment.

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.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TEm) Theory (master)	1	English	second semester	afternoon
(PLABm) Practical laboratories (master)	1	English	second semester	afternoon