RFID Technology and Sensor Systems

Code: 106955
ECTS Credits: 6

2025/2026

Degree	Type	Year
Management of Smart and Sustainable Cities	OP	4

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

It is advisable to have taken the following subjects:

- Fundamentals of Electronics

- Instrumentation and Sensors

- Digitization and Microcontrollers

Objectives and Contextualisation

The overall goal of the subject is to provide the basic knowledge and techniques that allow the student to enter the Internet of Things (IoT) sector and its applications in smart city management.The subject covers different technologies, such as RFID, NFC, intelligent sensing, positioning systems, sensor networks, IoT dashboards, etc.The subject will be carried out from an eminently practical approach and oriented to the application of each one of these technologies.

Learning Outcomes

1. CM17 (Competence) Distinguish the economic and environmental costs of the use of information and communication technologies.
2. KM23 (Knowledge) Understand the use of the information captured in monitoring and decision-making systems.
3. SM20 (Skill) Develop skills in writing and presenting business projects linked to the management of smart and sustainable cities.

Content

Short-range technologies: NFC, LF-RFID, HF-RFID

Long-range technologies: UHF-RFID, MW-RFID

Differences between active and passive technologies and applications (Integration of citizen cards, traffic management, mail and logistics management, etc.)

Analog and Digital sensors and embedded systems in digital sensing.

Positioning systems.Position and range sensors.Units of inertial measurement.

Introduction to DSPs and processor ESP32 D32 R1.

Sound and image.Voice recognition.Digital cameras.

Sensors for building and digitization in urban space.

MQTT and NODE-RED for IoT Dasboards.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory sessions	12	0.48	
Master classes	26	1.04	
Problems seminars	12	0.48	
Type: Supervised			
Tutorials outside of class hours	7.5	0.3	
Type: Autonomous			
Laboratory sessions preparation	12	0.48	
Solve problems at home	15	0.6	
Study at home	25	1	

For the 2025-26 academic year, this course will be offered in tutorial mode for students repeating from the previous year.

Year 2026-27:

Directed activities:

Master CLasses: The teacher will explain the topics using the projection cannon and blackboard.

Problem seminars: The teacher will perform, or in some cases the students themselves, example problems in small groups of students.

Laboratory sessions: Prior to the practice session, the student must prepare it and after it must submit a report.
Note: - The teaching materials of the subject will be available in the Virtual Campus of the UAB
-The preferred form of communication between teachers and students will be e-mail

Supervised activities: tutorials outside of class hours.

Autonomous activities:

Study at home

Solving class problems prior to completing them.

Preparation of Laboratory sessions.

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
Delivery of Lab reports	25	10.5	0.42	CM17, KM23, SM20
1st project delivery	37.5	15	0.6	CM17, KM23, SM20
2nd project delivery	37.5	15	0.6	CM17, KM23, SM20

The evaluation will be based on the submission of two projects (completed individually) with a weight of 37.5% each and the results of the laboratory practice reports (completed in groups) with a weight of 25%.

The projects will be averaged between them and if the average result is higher than 4 they will average with the practices.

In the event of not passing the course, the project component can be retaken by resubmitting the failed assignments. To participate in the retake, one must have previously been assessed in activities that account for at least 2/3 of the final grade for the course.

If the course is not passed, the final grade will correspond to the grade obtained in the projects.

Failure to attend any of the lab sessions or not having a grade in the projects will mean that the student will be declared non-assessable.
Granting an honorary enrollment grade is the decision of the faculty responsible for the subject. UAB regulations state that MHs can only be awarded to students who have obtained a final grade equal to or higher than 9.00. Up to 5% MH of the total number of students enrolled can be awarded.
Without prejudice to other disciplinary measures deemed appropriate, irregularities committed by the student that may lead to a variation in the grade of an assessment act will be graded with a zero. So, copying, plagiarism, cheating, copying, and so on. in any of the assessment activities it will involve suspending it with a zero. Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the course, this course will be suspended directly, without the opportunity to retake it in the same course.
In case of repeating thesubject, the same evaluation system will be followed as the rest of the students. For the 2025-26 academic year, the assessment for this course will involve resubmitting previously failed assignments or practical tasks. Students who have not attended the practical sessions during the 2025-26 academic year must pass a specific exam to complete the practical component successfully.
The Single Assessment System is not included in this course.
For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as bibliographic or information searches, text corrections, or translations. Students must clearly identify which parts have been generated using these technologies, specify the tools used, and include a critical reflection on how these have influenced the process and the final result of the activity. Lack of transparency regarding the use of AI in this assessed activity will be considered academic dishonesty and may result in partial or total penalties in the activity's grade, or more severe sanctions in serious cases.

Bibliography

1. V.D. Hunt, A. Puglia and M. Puglia. RFID. A guide to Radio Frequency Identification. John Wiley & Sons, New Jersey 2007.2. H. Lehpamer. RFID design principles. Artech House, Norwood 2008.3. D. M. Dobkin. The RF in RFID. Passive UHF RFID in Practice. Elsevier 2008.

2. H. Lehpamer. RFID design principles. Artech House, Norwood 2008.

3. D. M. Dobkin. The RF in RFID. Passive UHF RFID in Practice. Elsevier 2008.

4. Fortino, Giancarlo, Liotta, Antonio. Internet of Things. Technology, Communications and Computing. Springer. ISSN: 2199-1073

Software

- Tinkercad - For editing Arduino projects.

- Arduino Ide for programming ESP32 R32 D1 processors.

- NODE-RED and Mosquitto.

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.