COURSE DATA

DATA SUBJECT

Code: 36422
Name: Internet of things
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1406 - Degree in Data Science	Escola Tècnica Superior d'Enginyeria	4	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1406 - Degree in Data Science	Signals	COMPULSORY

COORDINATION

TORRES PAIS JOSE GABRIEL

PEREZ SOLER JOAQUIN

SUMMARY

This course introduces the basic principles of the Internet of Things (IoT), the main standardized IoT architectures and the different types of sensors and actuators in IoT.

In addition, students will learn about IoT-specific communication networks and services, illustrating their application to different use cases in Industry 4.0.

Finally, a complete IoT project will be created using the PYNQ platform.

The theory classes will be taught in Spanish and the practical and laboratory classes will be taught according to the course description available on the degree's website.

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 desirable that students have knowledge of programming in Phyton.
It is desirable that students have knowledge of processors and operating systems.

COMPETENCES / LEARNING OUTCOMES

1406 - Degree in Data Science

(CB5) Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

(CE10) Ability to digitally process signals and extract information from them.

(CE11) Ability to design and implement data acquisition, its integration, transformation, selection, verification of its quality and veracity from different sources, taking into account its character, heterogeneity and variability.

(CG01) Knowledge of basic subjects and technologies that enable students to learn new methods and technologies, and to provide them with versatility to adapt to new situations.

(CG06) Ability to access and manage information in different formats for subsequent analysis in order to obtain knowledge from data.

(CT02) To be able to complete technical, scientific, social and human training in general, and to organise self-learning with a high degree of autonomy.

(CT04) To be responsible for ones own professional development and specialisation, applying the acquired knowledge in the identification of career opportunities and sources of employment.

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

DESCRIPTION OF CONTENTS

1. Introduction to IoT and basic concepts

1. Internet of devices
2. Communication infrastructures for IoT (wireless communications, access networks and location systems)
3. Technologies for sensor and device networks (WiFi, Bluetooth/BLE, RFID/NFC, IPv6, 5G, GPS)
4. Heterogeneity and integration in systems for IoT
5. Current IoT application landscape

2. Standardized IoT architectures

1. Architectures for data acquisition nodes (Raspberry Pi, Arduino, PYNQ)
2. Software development environments for IoT (Android Things, Vivado, Jupiter).
3. Programming languages for IoT (C, Python)

3. Sensors and Actuators

1. Sensors and devices in common use
2. Hardware communication protocols (GPIO, ADC/DAC, UART, SPI, I2C)
3. Data acquisition in sensor and device networks
4. Data monitoring in IoT systems (HTTP)

4. IoT connectivity

1. Development of wireless sensor networks
2. IoT application programming (open data sources and streaming data)
3. Identification systems
4. Applied Analytics for IoT (Data Science, Computer Vision, Machine Learning)

5. Industry 4.0

1. Aplicaciones Smart (Smart-Cities, Smart-Tourism, Smart-Grid)

6. Development of an Internet of Things project

1. Development of an IoT project based on PYNQ with peripheral integration, data acquisition and data management

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	32,00
Laboratory	20,00
Classroom practices	8,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours

Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	15,00
Preparation of lessons	35,00
Preparation for assessment activities	10,00
Resolution of case studies	10,00
Total hours	**90,00**

TEACHING METHODOLOGY

The training activities will be developed according to the following distribution:

AF01. Theoretical activities: In the theoretical classes the subjects will be developed providing a global and integrating vision, analyzing in greater detail the key and more complex aspects, encouraging, at all times, the participation of the student.

AF02. Problem solving: As a complement to the theoretical activities, classroom discussion sessions will be held and problems and exercises previously worked on by the students will be solved. Group work will be encouraged in order to accustom the student to teamwork; typical in any practical development in Data Science.

AF03. Practical activities: Theoretical contents will be implemented and analyzed in small laboratory classrooms where students will have access to the appropriate equipment and software for this work.

AF04. Student's personal work: Outside the classroom, students will work on questions, problems and reports, as well as preparing for classes and exams (study). This task will be carried out individually and aims to promote autonomous work.

AF05. Assessment: Individual written assessment questionnaires/tests in the classroom with the presence of the teacher.
In terms of teaching methodology, the following will be followed:

MD1. Theoretical activities: Lecture development of the subject with student participation in the resolution of specific questions. Individual evaluation questionnaires. (CG01, CB1, CB4, CT02)

MD2. Practical activities: Learning by solving problems, exercises and case studies through which competences on the different aspects of the subject are acquired. (CG06, CB4, CT02, CE10)

MD3. Transversal competences: Visits to companies, attendance to courses, conferences, round tables and other types of activities organized and/or proposed by the CAT of the Degree. (CG06, CB1, CB4, CT02, CT04)

MD4. Laboratory and/or computer classroom work: Learning through activities carried out individually or in small groups and carried out in laboratories and/or computer classrooms. (CG06, CB4, CT02, CE10, CE11)

EVALUATION

In the first examination call, the subject will be assessed continuously as follows:

- SE3 - Continuous assessment of each student, based on their participation and level of engagement in the teaching-learning process, taking into account regular attendance at scheduled face-to-face activities and the resolution of proposed questions and problems. (20%). This activity is non-recoverable (CB2, CG03, CT05).
- SE2 - Assessment of practical activities, based on the completion of questionnaires, oral presentations, and practical designs during the sessions. (30%) (CB2, CB4, CB5, CG03, CG05, CG06, CE05, CE13).
- SE1 - Final examination, consisting of the development, presentation, and demonstration of a project based on the learning and development of the subject, as well as responses to theoretical and practical questions. (50%) (CB2, CB4, CB5, CG03, CG05, CG06, CE05, CE13).

To pass the subject, students must obtain a minimum mark of 4 out of 10 in each of the following: activity assessment, practical activities, and the final exam.

In the second examination call, a theoretical and a practical exam will be conducted, and the continuous assessment mark obtained in the first session will be retained. The weighting of each component will remain proportional to the same as in the first session.

In all cases, the assessment system will be governed by the Evaluation and Grading Regulations of the University of Valencia for Undergraduate and Master's Degrees (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639).

Any clear instance of copying or plagiarism in any activity forming part of the assessment will result in failure of the subject, and the student will be subject to the appropriate disciplinary procedures as outlined in the UNIVERSITY OF VALENCIA PROTOCOL FOR ACTION AGAINST FRAUDULENT PRACTICES (ACGUV 123/2020).

REFERENCES

- C. Pfister. Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) . O'Really. 2011.

- Rob Barton, David Hanes, Gonzalo Salgueiro. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. Cisco Press. 2017

- Louise H. Crockett, David Northcote, Craig Ramsay, Fraser D. Robinson, Robert W. Stewart. Exploring Zynq® MPSoC With PYNQ and Machine Learning Applications. Strathclyde Academic Media. 2019

- Jean-Philippe Vasseur;Adam Dunkels. Interconnecting Smart Objects with IP: The Next Internet. Morgan Kaufmann Publishers Inc. 2010

- Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle. From machine-to-machine to the Internet of things: introduction to a new age of intelligence. Kidlington Oxford: Academic Press. 2014

- Perry Lea. Internet of things for architects: architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security. Packt Publishing. 2018