Course guide
330728 - NSIOT - Network Solutions for Iot

Last modified: 07/07/2025

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: MASTER'S DEGREE IN MACHINE LEARNING AND CYBERSECURITY FOR INTERNET-CONNECTED SYSTEMS (Syllabus 2024). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Marquillas Estruch, Albert

Others:

TEACHING METHODOLOGY

AF1. Attendance and participation in master class. Presentation in class of new content and description of the study materials by the teacher and questions by the students to the teacher in relation to the content that he is explaining or presenting in the master class.
AF2. Attendance and participation in participatory class. Presentation of problems, challenges or case studies that students solve individually or in groups, with the teacher's assistance.
AF3. Carrying out laboratory practice. Completion in the laboratory and under the supervision of the teacher of tasks and experiments defined in the practice script, related to the implementation of the contents of the subject. It normally requires the preparation of a prior study and the preparation of a subsequent report. Possible field trips are considered within this typology.
AF4. Completion of tasks related to project-based learning. Students meet and manage the development of a complex project, organizing and distributing the necessary tasks and resources.
AF5. Presentation and defense of works. Students present to the rest of the class and the teacher how they have carried out the proposed tasks, be it solving problems, carrying out practices or developing projects.
AF6. Autonomous study carried out by the student outside of class hours. The student, autonomously, studies the content taught by the teacher, through notes and other materials provided by the teacher or obtained by the student himself.
AF7. Autonomous work carried out by the student outside of class hours. Tasks carried out autonomously, either individually or in a team, consisting of problem solving, exercises or the development of practices.
AF8. Attendance at tutoring session. Meeting of the student with the teacher or tutor to resolve specific doubts about content and tasks and assess the student's own progress.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the course, the student will be able to:

M.10.1 (K) Identify and categorize the main types of industrial sensors and devices useful in the context of the industry to acquire relevant data.
M.10.2 (K) Identify communication network standards suitable for industrial systems.
M.10.3 (K) Explain the nature, possibilities, limitations and importance of the use of high-performance computing technologies in certain fields of science and practice.
M.10.4 (S) Use entity relationship modeling, relational database design, and SQL to efficiently store, retrieve, and update data in a database.
M.10.5(S) Develop a system design based on the provided system requirements using advanced tools for a clear and structured design.
M.10.6 (S) Select the sensor that best suits a specific industrial application.
M.10.7 (S) Maintainable user interfaces and identify trends in multi-device UI implementation.
M.10.8 (S) Define, interpret and use professional terminology in the field of high-performance computing based on graphics processors.

CONTENTS

TOPIC 1: Introduction to Industrial Internet of Things (IIoT)

Description:
In this module it will be introduced the Industrial IoT (IIoT), seeing how it differences from consumer IoT, and exploring the reference architectures such as IIRA and IIAF.

Keywords: IIoT, IIRA.

Specific objectives:
Once the topic is covered, the student is expected to:

- Understand the differences between IIoT and consumer IoT
- Know the characteristics of an IIoT deployment
- Understand the reference architectures and how to use them

Related activities:
All the relevant ones.

Full-or-part-time: 7h
Theory classes: 2h
Self study : 5h

TOPIC 2: Industrial IoT Protocols

Description:
This module focuses on the different industrial protocols such as IO-Link, Modbus, and EtherCAT and the different types of gateways.

Keywords: industrial protocols

Specific objectives:
Once the topic is assumed, the student will:

- Understand the different industrial protocols
- Know which protocol suits best for a real case scenario

Related activities:
All the relevant ones.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

TOPIC 3: Cloud and Edge Computing

Description:
Overview of cloud computing architectures and service models (SaaS, IaaS, PaaS) and an overview of edge computing and its potential in the IIoT architectures.

Keywords: cloud computing, edge computing

Specific objectives:
Once the topic is done, the student will:

- Understand the capabilities of cloud and edge computing
- Differentiate between different services in the cloud
- Understand how to apply edge and cloud computing in different scenarios

Related activities:
All the relevant ones.

Full-or-part-time: 24h
Theory classes: 2h
Laboratory classes: 6h
Self study : 16h

TOPIC 4: AI and Big Data

Description:
This module will focus on big data applications in the industrial IoT and how this data, combined with AI, can be used to achieve better production and optimizations in the industrial processes.

Keywords: reinforcement learning, big data

Specific objectives:
Once the topic is covered, the student is expected to:

- Know how to apply AI algorithms with data
- Use common Big Data platforms

Related activities:
All the relevant ones.

Full-or-part-time: 25h
Theory classes: 2h
Laboratory classes: 6h
Self study : 17h

TOPIC 5: Security, Blockchain in IIoT

Description:
Exploration of cybersecurity challenges specific to IIoT, including strategies for securing industrial networks, data integrity, and protecting against cybersecurity threats. Also, it will be seen the applications of blockchain in IIoT, how it helps to secure and maintain data integrity.

Keywords: IIoT securization, cybersecurity

Specific objectives:
Once the topic is covered, the student is expected to:

- Understand the security problems that IIoT faces
- Know how to secure architectures
- Know the possibilities of blockchain

Related activities:
All the relevant ones.

Full-or-part-time: 8h
Theory classes: 2h
Self study : 6h

Topic 6: Automatas, Robots and Industrial Control

Description:
In this module the main components of industrial automatization with industrial IoT will be explained, where components such as PLCs, robots and SCADA will be presented in detail, and the relation between them and IIoT.

Keywords: automatization, control

Specific objectives:
Once completed, the student will be able to:

- Know how to relate all components in an IIoT infrastructure
- Deploy and plan a IIoT implementation
- Automatize industrial processes

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

ACTIVITIES

LECTURES

Description:
Face-to-face sessions specifically focused on understanding the subject content, especially the more theoretical content.

Material:
The support materials are:
- Main references of the subject.
- Collection of problems of the subject.

Full-or-part-time: 14h
Theory classes: 14h

LABORATORY WORK

Description:
Students practice implementing network solutions for IoT. This includes hands-on learning with face-to-face tutorials, as well as practical assignments. This may mean completing practicals during independent learning time.

Delivery:
During the lab sessions, the achievement of the objectives will be assessed taking into account reports and the degree of understanding of
the work demonstrated for each student.

The grade obtained in these activities defines the overall grade variable LAB1 and LAB2.

Full-or-part-time: 13h
Laboratory classes: 13h

INDEPENDENT STUDY

Description:
Independent study consists of studying to understand and solidify knowledge, vocabulary and techniques either alone or in a group.

Material:
The support materials are:
- Main references of the subject.
- Collection of tutorials of the subject

Full-or-part-time: 40h
Self study: 40h

EXAM

Description:
There will be a final exam consisting of a set of exercises to be solved on paper without any support material, in a short amount of time and on working alone.

Delivery:
The individual exam solutions are delivered and evaluated. The exam grade corresponds to the course grade variable FIN.

Full-or-part-time: 8h
Self study: 8h

GRADING SYSTEM

Overall grade = 0.40 * FIN + 0.30 * LAB1 + 0.30 * LAB2

EXAMINATION RULES.

The activities will be carried out following the uses and customs of academic work and, in particular, the following guidelines will be respected:

- Those activities that are explicitly declared as individual, whether they are face-to-face or not, will be carried out without any collaboration by other people.
- The dates, formats and other delivery conditions established will be mandatory.
- If any of the activities of the subject is not carried out, it will be considered graded with zero.
- The completion of laboratory activities is a necessary condition to pass the course.
- The use of the computer laboratory will be reserved exclusively for academic activities and in no case may abusive use be made.

BIBLIOGRAPHY

Basic:

- Minerva, R.; Biru, A.; Rotondi, D. Towards a definition of the Internet of Things (IoT) [on line]. 2014 [Consultation: 14/10/2025]. Available on: https://www.researchgate.net/publication/317588072_Towards_a_definition_of_the_Internet_of_Things_IoT.
- Gilchrist, Alasdair. Industry 4.0: the industrial internet of things [on line]. Berkeley, CA: Apress, [2016] [Consultation: 08/10/2025]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4573237. ISBN 9781484220474.
- Buyya, Rajkumar; Srirama, Satish Narayana. Fog and edge computing: principles and paradigms [on line]. 1st edition. Piscataqay, New Jersey: IEEE Xplore, 2019 [Consultation: 13/10/2025]. Available on: https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781119525080. ISBN 9781119525066.