Course guide
300263 - IOT-IP - Internet of Things and Ubiquitous IP

Last modified: 11/05/2026

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering.

Degree: MASTER'S DEGREE IN APPLIED TELECOMMUNICATIONS AND ENGINEERING MANAGEMENT (MASTEAM) (Syllabus 2015). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
ERASMUS MUNDUS MASTER IN COMMUNICATIONS ENGINEERING AND DATA SCIENCE (CODAS 1) (Syllabus 2024). (Optional subject).
ERASMUS MUNDUS MASTER IN COMMUNICATIONS ENGINEERING AND DATA SCIENCE (CODAS 2) (Syllabus 2024). (Compulsory subject).
MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE FOR CONNECTED INDUSTRIES (AI4CI) (Syllabus 2025). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: CARLOS GOMEZ MONTENEGRO

Others: Primer quadrimestre:
CARLOS GOMEZ MONTENEGRO - M1A21
M. ELENA LOPEZ AGUILERA - M1A21
ENRICA VALERIA ZOLA - M1A21

PRIOR SKILLS

- Fundamental mechanisms of the Internet: IPv4, IPv6, routing, transport (e.g. TCP), applications (e.g. SIP).
- Fundamentals of RF communication and protocols: physical and MAC layers.
- Ethernet and IEEE 802.11 networks: MAC layer switching/routing, WiFi functions (scan, exploration, association, handover, etc.).
- Cellular mobile communication networks: elements (base stations, data bases, switching elements, gateways, etc.) and functions (mobility management: location, handover, paging; attachment, power control, silence detection, etc.).
- Fundamentals of wireless multihop networks. Ad-hoc network routing protocols.
- Sensor networks.
- Probability and stochastic processes.

REQUIREMENTS

None.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world¿s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Basic:
CB6. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

TEACHING METHODOLOGY

The teaching methodology combines the following components:

- Traditional lectures incorporating students' participation through short activities in the class, such as short questions, problem solving, debates and presentations done by the students.

- Autonomous work, whereby students will complete the information provided by the teachers and will carry out activities with the goal of consolidating knowledge in the scope of the subject, with the teachers' support.

- Collaborative work, whereby teams of students will be mutually responsible for the learning process within a team.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student should be able to:

- Evaluate the Internet limitations, as well as the proposed solutions and the scenarios in which these will be used.
- Design a complete solution in terms of connectivity (technologies, protocol architecture, topology, etc.) for an Internet of Things application in a specific scenario.
- Choose and configure adequately the communication protocols for the Internet of Things.
- Choose and configure adequately optimization techniques for wireless communications at various protocol stack layers.
- Use the solutions for supporting the mobility of devices in the Internet.
- Analyze and select the best mobility support solution for a given scenario.
- Configure adequately the network parameters and mechanisms to mitigate the impact of the mobility of the devices connected to a network.

STUDY LOAD

Type	Hours	Percentage
Guided activities	3,0	4.00
Hours small group	2,0	2.67
Self study	48,0	64.00
Hours large group	22,0	29.33

Total learning time: 75 h

CONTENTS

Internet evolution

Description:
This unit provides a vision on the Internet evolution since its origins, focusing on the motivation, principles and near future use cases of IPv6 (the long term solution for Internet connectivity). The limitations of the native Internet architecture are shown, and possible solutions are offered.

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

Internet of Things: technologies and applications

Description:
This unit focuses on constrained node networks, the new IP-based protocol suite for their connection to the Internet, and smart applications enabled by these technologies in a wide range of environments such as cities, homes, buildings, agriculture, health, vehicles, etc.

Related competencies :
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world¿s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
CB6. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

Full-or-part-time: 31h
Theory classes: 9h
Laboratory classes: 2h
Self study : 20h

Wireless experience improvement

Description:
This unit provides tools for management, self-configuration and analysis for wireless network improvement, as well as end-to-end solutions and optimizations for wireless Internet access.

Related competencies :
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

Full-or-part-time: 13h
Theory classes: 5h
Self study : 8h

Mobility support

Description:
This unit provides tools for analysis, protocols and architectures for supporting the mobility of things, people and vehicles for network/Internet connectivity, enabling new applications. This unit includes the impact of mobility on the network parameters and their configuration.

Related competencies :
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

ACTIVITIES

Unit 2 laboratory

Related competencies :
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

Full-or-part-time: 2h
Laboratory classes: 2h

Unit 2 seminars

Related competencies :
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world¿s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
CB6. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.

Full-or-part-time: 2h
Theory classes: 2h

Unit 3 exercises

Related competencies :
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

Full-or-part-time: 1h
Theory classes: 1h

Unit 4 study case of a current scenario that involves mobility support

Related competencies :
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
06 URI N1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
CB9. Students will be able to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous manner.

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

Exam

Related competencies :
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world¿s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
CB6. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.

Full-or-part-time: 3h
Theory classes: 3h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

Described in SIA (Infoweb of the course)

EXAMINATION RULES.

Attendance is mandatory in laboratory activities and in classes involving oral presentation of tasks performed by students.

BIBLIOGRAPHY

Basic:
- Shelby, Zach; Bormann, Carsten. 6LoWPAN : the wireless embedded internet. Chichester, West Sussex, U.K. ; Hoboken, NJ: John Wiley & Sons, 2009. ISBN 9780470747995.
- Gómez, C; Paradells Aspas, Josep; Caballero Herrero, José Eugenio. Sensors everywhere : wireless network technologies and solutions. [S.l.]: Fundación Vodafone España, cop. 2010. ISBN 9788493474058.
- Santi, Paolo. Mobility models for next generation wireless networks : ad hoc, vehicular and mesh networks. Chichester: John Wiley & Sons, 2012. ISBN 9781119992011.