

## Course guides

### 230150 - XSF - Wireless Networks

**Last modified:** 13/05/2015

**Unit in charge:** Barcelona School of Telecommunications Engineering  
**Teaching unit:** 744 - ENTEL - Department of Network Engineering.

**Degree:** BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

**Academic year:** 2015    **ECTS Credits:** 6.0    **Languages:** Catalan

#### LECTURER

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**Coordinating lecturer:** ANNA CALVERAS

**Others:** Calveras Auge, Ana M.Paradells Aspás, JoseCasademont Serra, Jordi

#### PRIOR SKILLS

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C programming and linux knowledge

#### REQUIREMENTS

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Enginyeria Telemàtica o Ciències and Tecnologies de Telecomunicació o Enginyeria de Sistemes de Telecomunicació.

#### TEACHING METHODOLOGY

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- Lectures. - Classes of application. - Laboratory classes. - Group work (learning). - Individual (learning). - Oral presentations. - Exercises. - Short answer tests. - Testing long answer.

#### LEARNING OBJECTIVES OF THE SUBJECT

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- Introduce a new vision of communication networks based on ubiquitous networks and low power consumption. An example: sensor networks. - Introduce what is known as the Internet of Things, and Internet of Things (IOT), presenting the protocols used. - Offering a new vision of communication networks where simplicity is the key to reducing power consumption and price. - To complement the theoretical concepts with practical concepts. - Allow different degree of participation in the course.

#### STUDY LOAD

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Type	Hours	Percentage
Hours small group	26	17.33
Self study	98	65.33
Hours large group	26	17.33

**Total learning time:** 150 h



## CONTENTS

### 1. Organization course. Motivation. focus

**Description:**

Organization, motivation and focus of the course.

### 2. Apps

**Description:**

Key applications of wireless networks such as wireless: home automation and building, agriculture, infrastructure monitoring, "smart cities", logistics,

### 3. Plataforms

**Description:**

- Architecture of a wireless sensor node: Microcontroller, memory, actuator and transducer, transceiver, antennas, power (batteries, hardvesting). - Operating systems (Contiki presentation). Trading platforms: Elements; SoC SIP modules and platforms. Presentation Platform Zolertia (Z1). - Lab 1: Configuring and "Hello World". Configuration programming environment based on a virtualized Debian system that can run on Windows or Mac in September. Compilation and execution of the example "Hello World." - Lab 2: Ports, LEDs, timers and buttons. use buttons, LEDs and timers in the system Contiki.

### 4. Systems

**Description:**

Description of existing commercial systems such as Z-Wave, EnOcean, Insteon, ZigBee and IETF proposal (6LoWPAN/IPv6/UDP/CoAP).

### 5. Sensors and Actuators

**Description:**

- Review of different devices that can be connected to convert physical quantities to electrical and vice versa. existing interfaces - Lab 3: Sensors and actuators. Visualization of sensor data in digital format. Control actuators. Construction of a simple logic control based on the same node.

### 6. Interface radio and implications

**Description:**

Presentation of the radio interface and their implications. Frequency bands. Current consumption of the node met. Periods of activity. MAC level topology control, organization of nodes. Types of access control mechanisms to the environment. Support periods "idle."

### 7. IEEE802.15.4

**Description:**

- Description of the radio interface and MAC protocol most used currently in wireless sensor networks. Types of nodes. Frame formats, frame rates, access mechanisms. Use "beacons." Services. Improvements: IEEE802.15.4e, IEEE802.15.4a. - Lab 4: Transmission radio. Radio transmission, multicast and unicast. Viewing frames with protocol analyzer ("sniffer"). Measures RSSI and LQI.



## 8. Mid term exam

**Description:**

Mid term exam

## 9. IPv6

**Description:**

- Addressing and packet format. - ICMPv6 and Neighbor Discovery. - 6LoWPAN: adaptation layer between IEEE802.15.4 and IPv6. Header compression, fragmentation and reassembling.

## 10. Routing Protocols

**Description:**

- Basic Ideas routing in WSN. Proactive. Reactive Diffusion Geographic. - Example: ROLL. - Lab 5: Routing. Creating the network and routing.

## 11. Transport Protocols

**Description:**

- TCP, UDP. Reliability. Basics of TCP. Congestion control. - Lab 6: End-to-end connectivity. TCP and UDP communication in a multi-hop network.

## 12. REST based solutions

**Description:**

- HTTP COAP. Using proxies and gateways. Other alternatives. - Lab 7: Access to information COAP sensor.

## 13. Project

**Description:**

Construction of a complex system combining parts that were seen throughout the course: sensors and actuators, wireless communication, use of the Internet protocols (IPv6, UDP / TCP, HTTP / COAP). Groups of 3 or 4 people using at least two sensors data, an actuator and a server connected to the Internet. Must demonstrate sensing data, communication, processing, Internet connectivity and performance as a result of a specific process.

## 14. Presentation of selected projects

**Description:**

Presentation of selected projects



## ACTIVITIES

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### PRACTICAL SESSIONS

**Description:**

7 laboratory sessions spread over the course detailed in the syllabus.

**Full-or-part-time:** 14 h

Theory classes: 14h

### ORAL PRESENTATIONS

**Description:**

Oral presentation of the project developed during the course.

**Full-or-part-time:** 2 h

Theory classes: 2h

### (ENG) CONTROLS DE RESPOSTA CURTA

### EXAM

**Description:**

Evaluation Intermediate / Final.

**Full-or-part-time:** 1 h

Theory classes: 1h 30m

## GRADING SYSTEM

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Final exam: 40% Partial examination and controls: 15% Exercises and monitoring of classes: 15% group project: 15% laboratory practice: 15%

## BIBLIOGRAPHY

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**Basic:**

- Gomez, C.; Paradells, J.; Cavallero, J.E. Sensors everywhere: wireless network technologies and solutions. Fundacion Vodafone, 2010. ISBN 9788493474058.