Course guide
340460 - XASF - Wireless Networks: Technologies and Applications

Last modified: 03/04/2024

Unit in charge:	Vilanova i la Geltrú School of Engineering
Teaching unit:	744 - ENTEL - Department of Network Engineering.

Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2018). (Optional subject).

Academic year: 2024   **ECTS Credits:** 6.0   **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	Vidal Ferré, Rafael
Others:	Piney Da Silva, Jose Ramon Vidal Ferré, Rafael

PRIOR SKILLS

Knowledge of basic concepts of networks (stack of protocols) and the Internet
Basic knowledge of functions and mechanisms of security (authorization, authentication, encryption)
Basic Knowledge of Java Language Knowledge of OOP
Know how to reason about design class charts (MComp in AMEP terminology) and on sequence diagrams.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
I_CEIC4. CEIC4. Ability to design and implement communication systems software.
I_CETI1. CETI1. Ability to understand the environment of an organization and its needs in the field of information technology and communications.

I_CETI6. CETI6. Ability to design systems, applications and services based on network technologies, including internet, website, e-commerce, multimedia, interactive services and mobile computing.

Transversal:
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

Two types of classes will be differentiated, theory classes (50%) [*].

In the theory classes, the teacher presents in an expository way the knowledge to be developed in the subject using transparencies, which will be available in advance in atenea and other resources such as apps, technical documentation or examples solved on the blackboard.

In the laboratory classes, we will work in a guided and then autonomous way how to use these technologies in the development of Android applications and also a project around the Internet of Things (IoT) using the Arduino IDE, ESP32 devices and sensors and actuators. These sessions will be accompanied by non-classroom work aimed at solving small exercises, challenges or small programming projects.

[*] A part of the sessions included in the theory part of the timetable will also be dedicated to practical work.

LEARNING OBJECTIVES OF THE SUBJECT

The subject is designed so that the student acquires a broad base of knowledge, both theoretical and practical, related to networks wireless and in particular of those technologies present in our mobiles.

After completing the course, the student will be able to:

-To explain the basic concepts associated with wireless communications
-Identify the critical parameters that characterize a wireless technology
-To explain the operation of the most widely used wireless technologies in the field of the mobile (2G-5G, Wi-Fi, Bluetooth, NFC, GPS, UWB)
-Identify the benefits and functionalities offered by these technologies based on the knowledge of the version of the standards / specifications implemented for a specific commercial product
-Use tools (mobile applications) that allow to analyze the operation of these technologies and their testing
-Select the most suitable wireless technology based on certain requirements
-Understand the particularities of the application of these technologies and of the mobile in an IoT scenario
-Design and develop mobile applications that take advantage of these technologies
-Develop an IoT device and interact with it using these technologies.

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	50.00
Hours large group	30,0	50.00

Total learning time: 60 h

CONTENTS

T1-Introduction to wireless networks

Description:
Spectrum, attenuation, noise, interference, signal noise ratio (SNR), sensitivity, relation between capacity according to the SNR, access to the environment

Related activities:
[IoT] [proj_1]

Full-or-part-time: 22h
Theory classes: 3h
Laboratory classes: 6h
Self study : 13h

T2-Mobile communication networks

Description:
Description of the network, operator-paid relationship (SIM), technologies (2G-5G), performance and services.

Related activities:
[IoT] [proj_2]

Full-or-part-time: 24h
Theory classes: 4h
Practical classes: 6h
Self study : 14h

T3-Wi-Fi

Description:
Standard IEEE802.11 (evolution, features, performance and certifications), 2,4 GHz vs. 5 GHz ISM bands (available channels vs. propagation), network types (infrastructure, ad-hoc, mesh), frames (MAC addresses, type and format), security.

Related activities:
[IoT] [proj_3]

Full-or-part-time: 21h
Theory classes: 4h
Laboratory classes: 3h
Self study : 14h

T4-Bluetooth

Description:
Specifications (evolution, features and performance), Bluetooth Classic (topology, performance and services), Bluetooth Low Energy (topology, performance and services), types of devices (beacons).

Related activities:
[IoT] [proj_4]

Full-or-part-time: 24h
Theory classes: 4h
Laboratory classes: 6h
Self study : 14h

T5-NFC

Description:
Bases of operation and elements (tags), types of communication and performance. Applications (identity, stock automation).

Related activities:
[IoT] [proj_5]

Full-or-part-time: 20h
Theory classes: 2h
Laboratory classes: 6h
Self study : 12h

T6-GGNS and RTLS

Description:
Satellite-based positioning: GNSS (Global Navigation Satellite System). Operation, technologies (GPS, Glonass, Beidou, Galileo) and features. Positioning without satellites: RTLS (Real Time Locating System). Operation, technologies (UWB, BLE, Wi-Fi) and features.

Related activities:
[IoT] [proj_3]

Full-or-part-time: 11h
Theory classes: 1h
Laboratory classes: 3h
Self study : 7h

T7-Internet of Things

Description:
Definition of the concept, type of devices (sensors, actuators, memory, CPU) and key technologies related to the mobile (Wi-Fi, BLE and NFC), fields of application (home, city, vehicles, industry ...) and development of solutions (value chain).

Related activities:
[IoT]

Full-or-part-time: 28h
Theory classes: 12h
Self study : 16h

GRADING SYSTEM

20% exam content (week of partial)
30% activity [iot]
50% Project, divided into:
10% delivery activity [proj_1]
10% delivery activity [proj_2]
10% delivery activity [proj_3]
10% delivery activity [proj_4]
10% delivery activity [proj_5]

In case the mark of the exam condition the approved of the subject, it would be offered its recovery in the week of final examinations and then as a re-evaluation.