Course guide
270129 - IM - Wireless and Mobile Communications

Last modified: 30/01/2024

Unit in charge:	Barcelona School of Informatics
Teaching unit:	701 - DAC - Department of Computer Architecture.

Degree:	BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023   **ECTS Credits:** 6.0   **Languages:** Spanish

LECTURER

Coordinating lecturer:	JORGE GARCÍA VIDAL
Others:	Segon quadrimestre: JORGE GARCÍA VIDAL - 10

PRIOR SKILLS

Basic knowledge of TCP / IP networks and network protocols.
Basic knowledge of probability and linear algebra

REQUIREMENTS

- Prerequisite XC

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CTI1.1. To demonstrate understanding the environment of an organization and its needs in the field of the information and communication technologies.
CTI1.2. To select, design, deploy, integrate and manage communication networks and infrastructures in a organization.
CTI1.3. To select, deploy, integrate and manage information system which satisfy the organization needs with the identified cost and quality criteria.
CTI1.4. To select, design, deploy, integrate, evaluate, build, manage, exploit and maintain the hardware, software and network technologies, according to the adequate cost and quality parameters.
CTI2.1. To manage, plan and coordinate the management of the computers infrastructure: hardware, software, networks and communications.
CTI3.1. To conceive systems, applications and services based on network technologies, taking into account Internet, web, electronic commerce, multimedia, interactive services and ubiquitous computation.
CTI3.2. To implement and manage ubiquitous systems (mobile computing systems).
CTI3.4. To design communications software.

Generical:
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

TEACHING METHODOLOGY

* Classroom sessions
* Lab classes (python programming)
* Case-based sessions (mobile app design)

LEARNING OBJECTIVES OF THE SUBJECT

1.knowledge of specific problems in the radio transmission
2.know the technology of wireless networks
3.knowing the value chain of mobile Internet
4.know the basic processing techniques for smartphone sensors
5.understand the business models, development costs, marketing, competition, etc., associated with the development of a mobile application
6.work together to develop a design work
7.technologies know no children of short-range.
8.known auxiliary technologies: positioning, secure mobile payments, advertising insertion, etc.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours large group	45,0	30.00
Guided activities	6,0	4.00
Self study	84,0	56.00

Total learning time: 150 h

CONTENTS

The value chain of mobile Internet

Description:
The Mobile Internet before and after the iPhone. Value chain IM: Contents. On-line services. Distribution networks. Interface with the user. Devices. Applications. Regulation of use of frequencies. Networks with infrastructure and ad hoc networks.

Radio Transmission

Description:
Characteristics of the radio channel. Limitations of power. Limitations on bandwidth. Propagation. Commitments in power, bandwidth and transmission speed. Adaptation speeds. Multiantena systems. Code division multiplexing, time and frequency. Mobiles and health.

Cellular networks

Description:
Regulation of use of frequencies. Networks with infrastructure and ad hoc networks. Mobile operators. Evolution 2G, 2.5G, 3G, 3.5G, 4G i 5G. Architecture of cellular networks. Services and pricing.

WiFi Networks

Description:
IEEE 802.11. CSMA / CA. Different standards of physical (802.11b, 802.11g, 802.11a, 802.11n). Solutions security (WEP, WPA). New standards: 802.11ac, 802.11ah.

Low power wireless transmission technologies

Description:
Bluetooth. 802.15.4. RFID and NFC. Mesh Networks and adhoc networks. Sensor networks. 6LowPAN, CoAP.

Sensors and signal processing techniques

Description:
Sensors dels mòbils: aceleròmetres, magnetòmetres, giròscops. Sistemes de coordenades. Descripció de rotacions en 3D (angles de euler, quaternions). Filtres bàsics. Fusió de senyals. Filtre de Kalman.

LBS and Complementary Technology

Description:
Positioning techniques, GPS, and Based Location Services (LBS). Secure Payment. Mobile Advertising.

ACTIVITIES

Topic 1

Description:
The Mobile Internet before and after the iPhone. Value chain IM: Contents. On-line services. Distribution networks. Interface with the user. Devices. Applications. Networks.

Specific objectives:
3

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

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

item 2

Description:
Characteristics of the radio channel. Limitations of power. Limitations on bandwidth. Propagation. The radio channel capacity. Adaptation speeds. Multiantena systems. Code division multiplexing, time and frequency. Mobiles and health.

Specific objectives:
1

Full-or-part-time: 24h
Theory classes: 6h
Self study: 18h

item 3

Description:
IEEE 802.11. CSMA / CA. Different standards of physical (802.11b, 802.11g, 802.11a). Solutions security (WEP, WPA). New standards: 802.11n, 802.11p, 802.11.

Specific objectives:
2

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

Use case: Mobile Application Design

Description:
The goal is to design a mobile application. You can choose an application. It will analyze the applications available on Apple App Store or Android Market with similar characteristics, comparing our implementation with the competition. We will choose a business model (ie, how will money with this application), marketing, etc.. We will design the application (graphics, functionality, etc.). On a voluntary basis can we deploy the application for Android OS and IOS. In this case you can publish the application for the market.

Specific objectives:
3, 4, 5

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 20h
Laboratory classes: 9h
Self study: 11h

item 4

Description:
Mobile operators. Evolution 2G, 2.5G, 3G, 3.5G and 4G. Architecture of cellular networks. Services and pricing.

Specific objectives:
2

Full-or-part-time: 21h
Theory classes: 6h
Self study: 15h

Partial Review

Description:
Exam topics 1-3

Specific objectives:
1, 2, 3

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 6h
Guided activities: 1h
Self study: 5h

item 5

Description:
Bluetooth. Zigbee. RFID and NFC. Mesh Networks and adhoc networks. Sensor networks. 6LowPAN and CoAP.

Specific objectives:
7

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

item 6

Description:
Type of mobility. Support for mobility level 3 (IP phone). Support for mobility in cellular networks. Nomadic mobility. Protocols to support mobility transparent to Level 2.

Specific objectives:
2

Full-or-part-time: 9h
Theory classes: 4h
Self study: 5h

item 7

Description:
Positioning techniques and Location Based Services (LBS). Secure Payment. Mobile Advertising.

Specific objectives:
8

Full-or-part-time: 9h
Theory classes: 4h
Self study: 5h

item 8

Description:
Sensors. Signal processing

Specific objectives:
4

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 12h
Theory classes: 3h
Laboratory classes: 6h
Self study: 3h

Presentation mobile application

Description:
Presentation of the application designed

Specific objectives:
3, 4, 5, 6

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 6h
Guided activities: 3h
Self study: 3h

Final Exam

Description:
Review of issues 1-8

Specific objectives:
1, 2, 3, 4, 5, 6, 7, 8

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 13h
Guided activities: 3h
Self study: 10h

GRADING SYSTEM

Ep: Mideterm exam : 0 Ef: Final exam: 0 Ec: Use case: 0

Final mark = 0,8xMAX (Ef, 0, 75 x Ef +0,25 x Ep) + 2xEc

BIBLIOGRAPHY

Basic:

- Schwartz, M. Mobile wireless communications. Cambridge University, 2005. ISBN 0521843472.
- Roshan, P.; Leary, J. 802.11 wireless LAN fundamentals: a practical guide to understanding, designing, and operating 802.11 WLANs. Cisco Press, 2004. ISBN 1587050773.
- Milette, G.; Stroud, A. Professional android sensor programming. Wrox Press, 2012. ISBN 9781118183489.

BIBLIOGRAPHY