



IDENTIFYING DATA

Wireless and mobile networks

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|---------------------|---|----------|------|------------|
| Subject | Wireless and mobile networks | | | |
| Code | V05G300V01942 | | | |
| Study programme | Degree in Telecommunications Technologies Engineering - In extinction | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Optional | 4th | 1st |
| Teaching language | #EnglishFriendly Spanish Galician | | | |
| Department | | | | |
| Coordinator | López Bravo, Cristina | | | |
| Lecturers | Fondo Ferreiro, Pablo López Bravo, Cristina | | | |
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| Web | http://faitic.uvigo.es | | | |
| General description | The subject "Wireless and Mobile Networks" (redes sen fíos e móbiles) examines the area of wireless and mobile networks, one of the technological basis of the present society, studying the existing challenges for the communications protocols, and looks at the opportunities that provides continuous connectivity even in movement. | | | |
| | The focus of this subject will be on network protocols above physical layer (nevertheless, it will touch the most important physical layer properties). | | | |
| | The documentation will be available in english. | | | |
| | English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English. | | | |

Competencies

| | |
|-----------------|--|
| Code | |
| B3 | CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations |
| B4 | CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity. |
| B9 | CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics. |
| C85 (CE85/OP28) | The ability to analyze, plan and deploy wireless communication networks for different coverage ranges: metropolitan, local and short range. |
| D2 | CT2 Understanding Engineering within a framework of sustainable development. |
| D3 | CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc. |
| D4 | CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights. |

Learning outcomes

| | |
|------------------------------------|-------------------------------|
| Expected results from this subject | Training and Learning Results |
|------------------------------------|-------------------------------|

| | | | |
|--|----------|-----|----------------|
| Understand the main concepts of wireless communications. | B3 | C85 | D2 D3 |
| Understand the main concepts of mobile communications. | B3 | C85 | D2 D3 |
| Know the main protocols used in wireless communication networks. | B3 | C85 | D2 D3 |
| Know the architectures used in wireless communication networks. | B3 | C85 | D2 D3 |
| Ability to design mobile wireless networks. | B4 B9 | C85 | D2 D3 D4 |

Contents

| Topic | |
|--|---|
| Introduction to wireless communications | Channel characteristics Multiple access Modulation |
| Principles of operation of wireless networks | Mobility management Introduction to ubiquitous computing Ad hoc networks, routing Security Network topologies |
| Wide area networks | Architecture Mobile networks Network topologies Case study |
| Local networks | Architecture: ad hoc and infrastructure based networks User authentication approaches Security Case study |
| Low range networks | Architecture Bandwidth/power consumption balance Personal communication Industrial communication |

Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|-------------|-----------------------------|-------------|
| Lecturing | 19 | 38 | 57 |
| Mentored work | 6 | 28 | 34 |
| Laboratory practical | 13 | 39 | 52 |
| Report of practices, practicum and external practices | 0 | 3 | 3 |
| Systematic observation | 1 | 0 | 1 |
| Essay | 1 | 0 | 1 |
| Problem and/or exercise solving | 2 | 0 | 2 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

| | Description |
|----------------------|---|
| Lecturing | Professors present the main theoretical contents related to wireless and mobile networks. Through this methodology the competencies CG3 and CE85 are developed. |
| Mentored work | Team development of the design, implementation and validation of a protocol, system, application or service. Through this methodology the competencies CG3, CG4, CG9, CE85, CT2, CT3 and CT4 are developed. |
| Laboratory practical | Students will complete guided and supervised practices. Through this methodology the competencies CG3, CG4 and CE85 are developed. |

Personalized assistance

| Methodologies | Description |
|---------------|---|
| Lecturing | The professors of the course will provide individual attention to the students during the course, solving their doubts and questions. Questions will be answered during the master sessions or during tutorial sessions. Teachers will establish timetables for this purpose at the beginning of the course. This schedule will be published on the subject website. Tutorial sessions could also be agreed by appointment. |

| | |
|----------------------|--|
| Mentored work | The professors of the course will provide individual attention to the students during the course, solving their doubts and questions. Questions will be answered during the supervising sessions or during tutorial sessions. Teachers will establish timetables for this purpose at the beginning of the course. This schedule will be published on the subject website. Tutorial sessions could also be agreed by appointment. |
| Laboratory practical | The professors of the course will provide individual attention to the students during the course, solving their doubts and questions. Questions will be answered during the lab sessions or during tutorial sessions. Teachers will establish timetables for this purpose at the beginning of the course. This schedule will be published on the subject website. Tutorial sessions could also be agreed by appointment. |

| Assessment | | | | |
|----------------------|--|---------------|-------------------------------|-----------------------|
| | Description | Qualification | Training and Learning Results | |
| Lecturing | Students will be individually evaluated to assess what they have learned in master sessions. Two exams will be done: one at the middle of the term, and one at the end. | 30 | B3 | C85 |
| Mentored work | Students will be divided in groups to complete the design, implementation and validation of a protocol, a system, an application or service. The result will be evaluated after the delivery, having into account key aspects such as the correction, the quality, the performance and the functionalities. In addition, during the implementation of the works, the design and the evolution of the development will be evaluated. The evaluation will be by group and by person: each one of the members of a team must document his/her tasks and answer the questions related to them. | 50 | B3 B4 B9 | C85 D2 D3 D4 |
| Laboratory practical | Students will fill lab reports, individually, to assess the correct realization and understanding of the laboratory tasks. | 20 | B3 | C85 B4 |

Other comments on the Evaluation

In order to pass the course it is necessary to complete the different parts of the course (master sessions, practices in labs, and tutored works). The final grade will be the **weighted geometric mean** of the grades of the different parts (i.e. it is not possible to pass the subject with a zero in one part). If "x" is the grade obtained for the master sessions, "y" for the practices in labs, and "z" for the tutored works, the final grade will be $FG = x^{0.3}y^{0.2}z^{0.5}$.

During the first month, students must declare if they opt for continuous or eventual assessment. Students who select continuous assessment and submit the first task or lab report may not be listed as "Not Present".

Students that opt by the eventual assessment procedure, must submit an additional dossier with detailed information about the events and issues that arose during the execution of the different tasks, and especially the tutored work. In addition, during the first month of the course, professors will notify students if they have to do the tutored work individually, in the case they opt for unique assessment.

Second call and extraordinary calls

The assessment system will be the same as the eventual assessment of the first call.

Students that have opted by the continuous assessment procedure, can decide to maintain the grades of the parts they have already passed in the first call or discard them.

Other comments

The documentation will be in English. The course will be tough in Spanish and Galician (including exams). However students will be able to answer in English, Spanish or Galician, as they prefer.

The grades obtained are only valid for the current academic year.

Although the tutored work will be completed (if possible) in groups, the performance of each student in his or her group will be analyzed continuously

Although the tutored work will be completed (if possible) in groups, the performance of each student in his or her group will be monitored continuously. In the case in which the performance of a member of the group wouldn't be adequate compared with the performance of his or her team mates, he or she could be excluded from the group and/or qualified individually.

The use of any material during the tests will have to be explicitly authorized.

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

Sources of information

Basic Bibliography

Coty Beard, William Stallings, **Wireless communication networks and systems**, 1, Pearson Education, 2013

Viajy Garg, **Wireless Communications and Networking**, 1, Morgan Kaufmann-Elsevier, 2007

Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farre, **Wireless Networking Complete**, 1, Morgan Kaufmann-Elsevier, 2010

Kaveh Pahlavan, Prashant Krishnamurthy, **Networking Fundamentals: Wide, Local and Personal Area Communications**, 1, Wiley and Sons, 2009

Kevin Townsend, Carles Cufí, Akiba, Robert Davidson, **Getting started with Bluetooth Low Energy**, 1, O'Reilly, 2014

Complementary Bibliography

James F. Kurose, Keith W. Ross, **Computer Networking: A Top-Down Approach**, 7, Pearson Education, 2017

Recommendations

Subjects that it is recommended to have taken before

Data Networks: Technology and Architecture/V05G300V01542

Contingency plan

Description

In case of online tuition, the methodologies used and the tests performed will be the same as in the case of in-person tuition. The only expected modification is that they will be carried out via Remote Campus and Faitic, instead of the School classrooms and laboratories.

ADDITIONAL REFERENCES

- Prof. Dr. Otto Spaniol, RWTH Aachen University (Mobile Communications Slides):

<http://www.nets.rwth-aachen.de/content/teaching/lectures/sub/mobil/WS07-08/>

- Technical Overview of IEEE 802.11 WLAN Standards: <http://cp.literature.agilent.com/litweb/pdf/5990-9697EN.pdf>

- Wi-Fi Alliance: <http://www.wi-fi.org/>

- Bluetooth Specifications: <https://www.bluetooth.com/specifications>

- Bluetooth Technology:

<https://www.bluetooth.com/develop-with-bluetooth/developer-resources-tools/developer-training-videos>

- Bluetooth mesh networking: <https://www.bluetooth.com/blog/introducing-bluetooth-mesh-networking/>

- ZigBee Alliance: <http://www.zigbee.org>

- Ramón Agustí, Francisco Bernardo, Fernando Casadevall, Ramón Ferrús, Jordi Pérez-Romero, Oril Sallent, **LTE: Nuevas tendencias en comunicaciones móviles**, Fundación Vodafone España, 2010.

http://www.vodafone.es/static/fichero/pre_ucm_mgmt_002620.pdf