Universitat de les Illes Balears

Academic year	2015-16
Subject	22380 - Advanced Wireless Networks
Group	Group 4, 2S
Teaching guide	A
Language	English

Teaching guide

Subject identification

Subject 22380 - Advanced Wireless Networks
Credits 2.4 de presencials (60 hours) 3.6 de no presencials (90 hours) 6 de totals (150 hours).
Group Group 4, 2S (Campus Extens)
Teaching period Second semester
Teaching language English

Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Jaume Ramis Bibiloni jaume.ramis@uib.es	11:30	12:30	Monday	01/09/2015	31/01/2016	135
	15:30	16:30	Monday	01/09/2015	31/01/2016	135
	11:30	12:30	Tuesday	01/02/2016	31/07/2016	135
	15:30	16:30	Tuesday	01/02/2016	31/07/2016	135
Felipe Riera Palou felip.riera@uib.es	17:30	19:30	Monday	14/09/2015	31/01/2016	Despatx 109

Contextualisation

Advanced Wireless Networks is an optional module addressed to students on the 4th year of the degree Grau en Enginyeria Telemàtica and whose objective is to provide an overview of the technologies and standards supporting modern wireless networks. Contents developed in this module should allow the student to understand the evolution and underpinning principles of the latest generation of wireless local area networks (IEEE 802.11n/ac), cellular standards (LTE), WiMAX (IEEE 802.16e) and personal area networks (WiMedia). Within the degree's conceptual map (eps.uib.es/mapa), this module belongs to the Communication Systems block.

Requirements

Recommendable

To take full advantage of this course, it is essential that students have the knowledge corresponding to the blocks of Telecommunications and Telematic Networks, detailed below:

* Xarxes d'Àrea Local i Intranets
* Xarxes d'Operadora

Date of publication: 30/07/2015

* Transmissió de Dades

Skills

Specific

* CC1: Capacity to autonomously acquire new skills and knowledge related to the design, development or exploitation of telecommunication systems and services..
* CC3: Capacity to use search engines related to bibliographic resources related to telecommunications and electronics.
* CC4: Capacity to analyze and specify the main parameters of a communication system.
* CC12: Ability to use concepts related to network architecture, protocols and internetworking..

Generic

* CG6: Oral expression: clarity and fluency to convey information related to results, products or services, to either specialized or non-specialized audiences..
* CG12: Ability for future autonomous study (lifelong learning).

Basic

* You may consult the basic competencies students will have to achieve by the end of the degree at the following address: http://www.uib.eu/study/grau/Basic-Competences-In-Bachelors-Degree-Studies/

Content

Theme content

A. Core concepts and enabling technologies

A.1. Review of radio transmission key concepts
- Channel propagation
- Diversity

A.2. Multiple antenna systems
- SISO capacity expression
- MIMO capacity expression
- Antenna selection
- Spatial multiplexing
- Space-time block coding (Alamouti)
- Cyclic delay diversity
- LAB MIMO + Questionnaire

A.3. Multicarrier architectures
- Review of the orthogonality concept
- OFDM basic mechanism
- Classic OFDM-based transmitter and receiver
- MIMO-OFDM architecture
- OFDMA extensions

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LAB OFDMA + Questionnaire

A.4. Adaptive Modulation and Coding Techniques
Lab AMC

A.5. Modern ARQ techniques
Lab ARQ

A.6. Packet scheduling
Lab Scheduling

B. Modern wireless communication standards

B.1. IEEE 802.11n/ac/ad/ah
802.11x PHY layer
802.11x MAC layer
Extensions for IEEE 802.11ac/ad
Questionnaire

B.2. 3GPP-LTE and LTE-A
OFDMA architecture within LTE (downlink and uplink)
Transmitter/Receiver processing chain for uplink and downlink
Channel organization in LTE
Radio resource management within LTE
Advanced techniques in LTE-A.
Questionnaire

B.3. Further wireless standards
IEEE 802.16e (WiMAX)
IEEE 802.15.3 (WPANs)
Questionnaire

C. 5G Visions

C.1. Students' presentation on 5G topics
Students will need to prepare and present a report on any of the topic that are currently being discussed within the context of 5G communications. Examples include:
cognitive radio, multi-tier architectures, BS cooperation, millimeter wave communications, filterbank-based multicarrier, 3D beamforming

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lectures	Large group (G)	To develop the contents of the module. Material will be made available through Campus Extens. CC1, CC4, CC12 and CG12.	34
Practical classes	Lab sessions	Large group (G)	To consolidate through computer experiments (Matlab) the material introduced in the theory lectures.	18

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Modality	Name	Typ. Grp.	Description	Hours
			CC1, CC3, CC4, CC12 and CG6.	
Assessment	Exams	Large group (G)	Students must take two exams during the term assessing the material of blocks A and B . CC1, CC4 and CC12 skills will be assessed.	4
Assessment	Report-presentation	Large group (G)	Students will develop a survey report and presentation related to a topic concerning 5G communications and they will have to present it in class. Skills CC3, CG6 and CG12 will be assessed.	4

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Group or individual self-study	Classroom activities study	Students will consolidate the contents introduced in class.	90

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

There are two available itineraries for this module:
-Itinerary A, is the standard one and relies on a continuous assessment of the student's work. To join this itinerary, a minimum attendance of 80% is required.
-Itinerary B, is only available to part-time students does not take into account class attendance/attitude.

The continous assessment modality (Itinerary A) consists of a partial exam of the material in Block A with a 40% weight, a partial exam of the material in Block B with a weight of 25%, lab-reports with a weight of 15% and a report-presentation on a 5G topic with a weight of 15%. The remaining 5% depends on the class attendance and attitude of the students. To pass this module students should at least obtain a minimum mark of 5 (out of 10) in all courseworks/exams. Students will be allowed to resit any failed parts in July's extraordinary examination term.
The final exam assessment modality (Itinerary B) will consist of a "double" exam (one for Block A (weight 40%) and one for Block B (weight 25%)), lab-reports with a weight of 15% and a report-presentation on a 5G topic with a weight of 20%. To pass this module students should at least obtain a minimum mark of 5 (out of 10) in all courseworks/exams. Any coursework will have to be delivered by the exam date. Students will be allowed to resit any failed parts in July's extraordinary examination term.

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Lectures

Modality	Theory classes
Technique	Attitude scales **(non-retrievable)**
Description	To develop the contents of the module. Material will be made available through Campus Extens. CC1, CC4, CC12 and CG12.
Assessment criteria	- Degree of participation of students in class, quality and soundness of their reasonings and precision and accuracy in their answers.

Final grade percentage: 5% for the training plan A with minimum grade 0
Final grade percentage: 0% for the training plan B with minimum grade 0

Lab sessions

Modality	Practical classes
Technique	Student internship dissertation **(retrievable)**
Description	To consolidate through computer experiments (Matlab) the material introduced in the theory lectures. CC1, CC3, CC4, CC12 and CG6.
Assessment criteria	- Quality and soundness of the development of the report. - Precision, conciseness, clarity, consistency and spelling and grammatical correctness of the document.

Final grade percentage: 15% for the training plan A with minimum grade 5
Final grade percentage: 15% for the training plan B with minimum grade 5

Exams

Modality	Assessment
Technique	Objective tests **(retrievable)**
Description	Students must take two exams during the term assessing the material of blocks A and B . CC1, CC4 and CC12 skills will be assessed.
Assessment criteria	- Quality and soundness of reasoning in: proposed solutions to problems answers to questions - Precision and accuracy of the results. - Clarity, intelligibility and spelling and grammatical correctness in answers.

Final grade percentage: 65% for the training plan A with minimum grade 5
Final grade percentage: 65% for the training plan B with minimum grade 5

Report-presentation

Modality	Assessment
Technique	Papers and projects **(retrievable)**
Description	Students will develop a survey report and presentation related to a topic concerning 5G communications and they will have to present it in class. Skills CC3, CG6 and CG12 will be assessed.
Assessment criteria	- Quality and soundness of the development of the project.

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- Precision, conciseness, clarity, consistency and spelling and grammatical correctness of the document.

Final grade percentage: 15% for the training plan A with minimum grade 5
Final grade percentage: 20% for the training plan B with minimum grade 5

Resources, bibliography and additional documentation

Basic bibliography

- Emerging Technologies in Wireless LANs: Theory, Design, and Deployment, Benny Bing, Cambridge University Press, 2007
- 4G, LTE/LTE-Advanced for Mobile Broadband, Erik Dahlman, Stefan Parkvall, Johan Sköld, Academic Press, 2011

Complementary bibliography

- Wireless Communications, Andrea Goldsmith, Cambridge University Press, 2005

Other resources

- All the information, slides and working material will be available at the web page in Campus Extens.
- Scholar and IEEExplore.

Date of publication: 30/07/2015