Universidade de Vigo

IDENTIFYING DATA

Wireless Systems and Networks

Subject	Wireless Systems and Networks
Code	V05G300V01615
Study programme	Degree in Telecommunications Technologies Engineering

Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd

Teaching language	Spanish
Department	Signal Theory and Communications
Coordinator	Pérez Fontán, Fernando
Lecturers	Pérez Fontán, Fernando Vazquez Alejos, Ana
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General description	(*)(*) A general overview of current wireless communications systems will be provided including standards and dimensioning issues.

Competencies

Code	
B2	CG2: The knowledge, comprehension and ability to apply the needed legislation during the development of the Technical Telecommunication Engineer profession and aptitude to manage compulsory specifications, procedures and laws.
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.
B7	CG7: The ability to analyze and assess the social and environmental impact of technical solutions.
C21	CE21/ST1 The ability to construct, exploit and manage telecommunication networks, services, process and applications, considered as systems of receiving, transporting, representation, processing, storage, management and presentation of multimedia information from the point of view of transmission systems.
C22	CE22/ST2 The ability of applying the basic techniques of telecommunication networks, services and applications for mobile and fixed environments, personal, local or long distance, with different bandwidth, including telephony, radio broadcasting, TV and data, from the point of view of transmission systems.
C25	CE25/ST5 The ability to select transmission antennas, equipment and systems, propagation of guided and non-guided waves, with electromagnetic, radiofrequency and optical media, and their corresponding radio electric spectrum management and frequency designation.
D2	CT2 Understanding Engineering within a framework of sustainable development.

Learning outcomes

Expected results from this subject	Training and Learning Results		
Cellular and wireless network specifications.	B7	C22	
To apply previously acquired knowledge on wave propagation for the planning of radio networks.		C21	
To specify the various elements (antennas, transmitters and receivers) which make up a global system.	B2	C25	D2
Provide access solutions to communications systems.	B4	C22	
Develop roll-out models which minimize the social and environmental impact of the radio communication networks, understanding the ethic and moral responsibilities involved in such work.	B2	C22	D2

Contents

Topic

Theory 1. Introduction to radiocommunications	Basic concepts Current situation Wireless LANs Personal networks.
Theory 2. Cellular systems	Fundamental concepts The radio propagation channel Multiple access techniques Interferencr Traffic theory Network sizing up Countermeasures Medium access control. Security and access control. Network management. Mobility management. Quality of service.
Theory 3. Review of cellular and wirelss lan standards and other proposals	Cell network generations. Other radio systems. WILAN. Evolution for the technological solutions in each generation.
Tutored work 1. Statistical analysis of simulated and/or measured time-series	Analysis of simulated and/or experimental time-series
Tutored work 2. Introduction to multipath effects	Reproducing multipath fading Doppler effect Narrow and wideband channel
Tutored work 3. Introduction of blockage/shdowing effects	Simulation of the shadowing effect Call handover Interference
Lab. 1. Introduction tho the radio channel	Statitical representation. Impulse response, channel parameters, channel types.
Lab 2. Channel effects on 3G and 4G	Multipath and shadowing; comparison of signal operation for CPM, WCDMA and OFDM; MIMO and diversity.
Lab 3. Introduction to 4G standard LTE	Radio planning and capacity analysis
Lab 4. Introduction to WLAN systems	Radio planning and capacity analysis

Planning

	Class hours	Hours outside the classroom	Total hours
Supervised work	7	14	21
Problem solving	6	18	24
Computer practices	14	28	42
Lecturing	13	26	39
Short answer tests	1	0	1
Practices report	0	8	8
Problem solving	1	0	1
Essay	0	14	14

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

Methodologies

	Description
Supervised work	GROUP AND INDIVIDUAL. Simulation work to be carried out in Matlab language will be proposed to C class gropus where they will go deeper into specific issues discussed in less detail in the theoretical classes. Through this methodology the competencies CG2, CG4, CG7, CT2 and CE21
Problem solving	INDIVIDUAL.The theoretical treatment of the various topics studied in theoretical classes will be complemented by performing numerical calculations relative to radio network dimensioning. Through this methodology the competencies CG2 and CE22
Computer practices	GROUP AND INDIVIDUAL. In laboratory sessions (type B) various Matlab simulations will be proposed to the students in order to study specific topics which are more suitably aproached this way. Through this methodology the competencies CE21, CE22 and CE25
Lecturing	INDIVIDUAL. In classroom lectures the more theoretical issues will be presented. Through this methodology the competencies CE21, CE22, CE25 and CT2

Personalized attention

Methodologies	Description
Lecturing	The student will be able to consult individually during tutoring hours all his/her doubts arising during the study of the theoretical contents as well as in the resolution of numerical exercises, laboratory work and supervised projects

	Supervised work	The student will be able to consult individually during tutoring hours all his/her doubts arising during the study of the theoretical contents as well as in the resolution of numerical exercises, laboratory work and supervised projects
	Problem solving	The student will be able to consult individually during tutoring hours all his/her doubts arising during the study of the theoretical contents as well as in the resolution of numerical exercises, laboratory work and supervised projects
	Computer practices	The student will be able to consult individually during tutoring hours all his/her doubts arising during the study of the theoretical contents as well as in the resolution of numerical exercises, laboratory work and supervised projects

Assessment

	Description	Qualification	Training and Learning Results
Short answer tests	Adequate kowledge of the theoretical materials of the lecture will be assessed by means of short response questions during the final exam. A minimum mark of 3 over 10 points is set for this part. Continued class attendance will be evaluated.	25	C21 D2 C22 C25
Practices report	For each lab assignment, the students in pairs, will present an individual written report. The evaluation will be carried out by means of (1) group reports and (2) an specific part in the final exam to be taken individually. The weights of parts one and two will be 1/3 and 2/3, respectively. A minimum mark of 3 over 10 points is set for this part. Continued class attendance will be evaluated.	25	C21 D2 C22 C25
Problem solving	In the final exam, there will be a part containing various short numerical problems. A minimum mark of 3 over 10 points is set for this part.Continued class attendance will be evaluated.	25	B2 C21 C22 C25
Essay	The evaluation of supervised group work (C classes) will be carried out through (1) a group report and (2) a specific test to be taken individually. The weights of parts one and two will be 1/3 and 2/3, respectively. A minimum mark of 3 over 10 points is set for this part.Continued class attendance will be evaluated.	25	B4 C21 B7 C22 C25

Other comments on the Evaluation

If possible all skills pertaining to this subject will be evaluated in all the various tests and exercises proposed: short answer tests, lab reports, problem solving and projects

For those who choose to take the final exam (alternatively to continuous assessment), this will have a weight of 100% of the final grades and will cover all issues dealt with in the theoretical lectures, the problem solving lectures, tutored group work and laboratory.

As a minimum grade is set for each parts making up the final evaluation, if this threshold is not exceed in any of the four parts, the final mark will be limited as a maximum to this threshold.

The schedule for the various intermediate tests will be decided at a (Academic Commission) CAG meeting and published at the beginning of the semester

The grades for the lab. work and group work will only be valid during the current school year.

Those students who choose the continuous assessment option shall inform the professor of this during the first few weeks of the school term. The continuous assessment option entails the completion of all activities proposed: lab works and group work, and taking all tests comprising the continuous assessment route. Those students not fulfilling the above will be assessed with the final exam only.

A student will be atributed the "no presentado" grade if he or she has not followed the full continuous assessment route and has not taken the final exam.

For the retake call (July), the grades obtained in the lab work and group work parts will be kept for those students following the continous assessment route and will only be required to take the theory, problems and lab parts of the new final exam.

Should a case of plagiarism be detected in any of the various activities and tests , the final mark will be FAILED (0) and the school direction team will be advised on the fact.

Sources of information
Basic Bibliography
José María Hernando Rábanos, **Comunicaciones Móviles. 2ª ed.**, Ed. Centro de Estudios Ramón Areces, S.A.,

F.Pérez-Fontán and P.Mariño Espiñeira, **Modeling of the wireless propagation channel. A simulation approach with Matlab**, Wiley,

Oriol Sallent Roig, Jordi Pérez Romero, **Fundamentos de diseño y gestión de sistemas de comunicaciones móviles celulares**, UPC,

Complementary Bibliography

Fernando Pérez Fontán, Sigfredo Pagel Lindow, **Introducción a las. Comunicaciones Móviles**, Servicio de Publicaciones. Universidad de Vigo,

José María Hernando Rábanos, **Comunicaciones Móviles de Tercera Generación**, Telefónica Móviles,

Simon R. Saunders, **Antennas and Propagation for Wireless Communications Systems**, Wiley,

José María Hernando Rábanos, Fernando Pérez Fontán, **Introduction to Mobile Communications Engineering**, Artech House,

Ramón Agustí Comés, **LTE: nuevas tendencias en comunicaciones móviles**, Fundación Vodafone,

Recommendations

Subjects that it is recommended to have taken before

Physics: Fields and Waves/V05G300V01202
Mathematics: Probability and Statistics/V05G300V01204
Fundamentals of Sound and Image/V05G300V01405
Digital Signal Processing/V05G300V01304
Signal Transmission and Reception Techniques/V05G300V01404
Electromagnetic Transmission/V05G300V01303
Radio Frequency Circuits/V05G300V01511
Radio Communication Systems/V05G300V01512