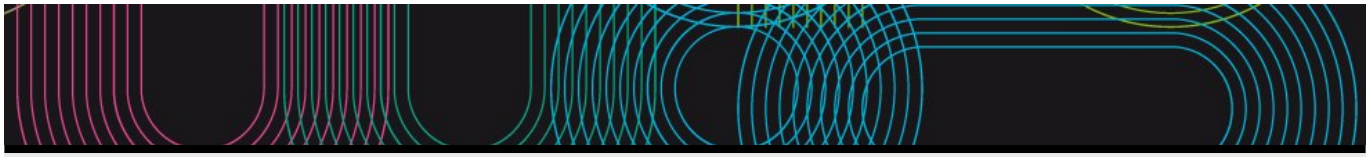

IDENTIFYING DATA				
Wideband Radio Systems				
Subject	Wideband Radio Systems			
Code	V05M145V01312			
Study programme	Máster Universitario en Ingeniería de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	García Sánchez, Manuel			
Lecturers	García Sánchez, Manuel Santalla del Río, María Verónica			
E-mail	manuel.garciasanchez@uvigo.es			
Web	http://moovi.uvigo.es			
General description	Wideband radio systems.			

Training and Learning Results	
Code	
C19	CE19/RAD2 Ability to perform theoretical design, experimental band systems measurement and practical implementation broadband for current applications

Expected results from this subject	Training and Learning Results
Theoretical and experimental knowledge of wideband systems	C19
Knowledge of designs of wideband active and passive elements	C19
Fundamentals of wideband signal generation and reception	C19
Fundamentals of wideband signal measurement	C19

Contents	
Topic	
Introduction	Definitions and basic concepts Communicaction systems Radio systems. Antennas. Radioelectric spectrum. Modulation. Radio channel. Propagation channel.
Description of the radio channel	Free space Undistorted transmission Attenuation. Multipath Fading. Doppler spread. Delay spread. Frequency selective channels. Precursors.
Mathematical characterization	Narrowband Statistical amplitude distributions Doppler spectrum Wideband Bello formulation

Channel sounders	Narrowband Doppler. Nyquist limit. Wideband. Frequency domain sounders: VNA Time domain sounders. RF pulse. Sliding correlation sounders. Sounder design and performance assesment. Narrowband sounder with spectrum analyzer 0 span. VNA based sounder. Sliding correlation sounder.
Channel sounders lab	Building a wideband sounder to measure the radio channel.
Wideband modulations	Delay spread. Inter symbol interference. Irreducible BER. Frequency hopping: GSM OFDM. Guard interval. Pilot tones. Equalization. PAPR. Amplifiers. DVB-T. 4G. CDMA. Processing gain. Noise. Adquisition and tracking. RAKE receiver. 3G. Power control. Cellular breathing.
UWB systems	1. Definition. Specificities. Regulation 2. Channel characteristics. 3. Impulse radio UWB. 4. Multiband OFDM approach to UWB. 5. Applications
Wideband and UWB antenna design	1. Wideband antennas. Definition and requirements. 2. Characterization of wideband antennas 3. Examples and applications. 4. UWB antennas. Definition and requirements. 5. Characterization of UWB antennas 6. Examples and applications.
UWB applications	Radar Ground penetrating radar Positioning and location Medical imaging Emerging applications

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	10	28	38
Flipped Learning	9	40	49
Lecturing	10	20	30
Laboratory practice	0	2	2
Objective questions exam	1	2	3
Objective questions exam	1	2	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Laboratory practical	Building and testing wideband radio channel sounders
Flipped Learning	Theoretical foundations of wideband systems
Lecturing	Presentation by the lecturer

Personalized assistance	
Methodologies	**Description**
Laboratory practical	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. (www.teleco.uvigo.es)
Flipped Learning	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. (www.teleco.uvigo.es)
Lecturing	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. (www.teleco.uvigo.es)
Tests	**Description**
Laboratory practice	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. (www.teleco.uvigo.es)

Objective questions exam	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. (www.teleco.uvigo.es)
Objective questions exam	The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. (www.teleco.uvigo.es)

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practice	Practice written and oral reports.	30	C19
Objective questions exam	Exam during last class	30	C19
Objective questions exam	Exam in the official date fixed by the school	40	C19

Other comments on the Evaluation

Regular call: We offer the students two schemes of assessment: continuous assessment and global assessment. The students will have to opt by one of the two schemes before a given date.

Special call: just global exam.

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

J.D. Parsons, **The Mobile Radio Propagation Channel**, Wiley,

Complementary Bibliography

H. Schulze, **Theory and applications of OFDM and CDMA**, Wiley,

M. Ghavami L.B Michael R. Kohno, **Ultra Wideband signals and systems in communication engineering**, Wiley, 2007

W. Pam Siriwongpairat K.J. Ray Liu, **Ultra-Wideband Communications systems. Multiband OFDM approach**, Wiley, 2008

W. Wiesbeck, G. Adamiuk, C. Sturm, **Basic Properties and Design Principles of UWB Antennas**, 2009

P. Bello, **Theory and applications of OFDM and CDMA**, 1963

J.D. Parsons, D.A. Demery and A.M.D. Turkmani, **Sounding techniques for wideband mobile radio channels: a review**, 1991

David D. Wentzloff,, **System Design Considerations for Ultra-Wideband Communication**, 2005

Recommendations