## IDENTIFYING DATA
### Wideband Radio Systems

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|---|---|---|---|---|
| Subject | Wideband Radio Systems | | | |
| Code | V05M145V01312 | | | |
| Study programme | Telecommunication Engineering | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 5 | Optional | 2nd | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | García Sánchez, Manuel | | | |
| Lecturers | García Sánchez, Manuel<br>Santalla del Río, María Verónica | | | |
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| Web | http://www.faitic.uvigo.es | | | |
| General description | Wideband radio systems. | | | |

## Competencies

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

## Learning outcomes

| 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<br>Communicaction systems<br>Radio systems. Antennas. Radioelectric spectrum. Modulation.<br>Radio channel. Propagation channel. |
| Description of the radio channel | Free space<br>Undistorted transmission<br>Attenuation.<br>Multipath<br>Fading. Doppler spread.<br>Delay spread. Frequency selective channels.<br>Precursors. |
| Mathematical characterization | Narrowband<br>Statistical amplitude distributions<br>Doppler spectrum<br>Wideband<br>Bello formulation |

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

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Seminars | 2 | 6 | 8 |
| Laboratory practises | 20 | 60 | 80 |
| Master Session | 6 | 18 | 24 |
| Short answer tests | 1 | 5 | 6 |
| Practical tests, real task execution and / or simulated. | 1 | 6 | 7 |

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

## Methodologies

| | Description |
|---|---|
| Seminars | Activities designed to work on a specific topic , which allow deepen or complement the contents of the subject. |
| Laboratory practises | Building and testing wideband radio channel sounders |
| Master Session | Master lecture given by the teacher |

## Personalized attention

| Methodologies | Description |
|---|---|
| Master Session | The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. |
| Laboratory practises | The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. |

## Assessment

| | Description | Qualification | Training and Learning Results |
|---|---|---|---|
| Laboratory practises | Practice written and oral reports. | 40 | C19 |
| Master Session | Short answer test | 60 | C19 |

**Other comments on the Evaluation**

First call:

Following the guidelines of the master we offer to the students  two schemes of evaluation: continuous assessment and final assessment. The students will have to opt by one of the two schemes before a given date.

Second call: just final exam.

**Sources of information**

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

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

**Recommendations**