



IDENTIFYING DATA

(*)Sistemas de comunicacións por radio

Subject	(*)Sistemas de comunicacións por radio			
Code	V05G300V01512			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Rubiños López, José Óscar			
Lecturers	Arias Acuña, Alberto Marcos García Pino, Antonio Rubiños López, José Óscar			
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General description	This course is devoted to the study of the fundamentals of radio communications systems, including the antennas, the link budget as well as those factors that limit the correct reception such as noise and interference.			

Competencies

Code	
A2	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.
A4	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.
A30	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.
A31	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.
A34	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.

Learning aims

Expected results from this subject	Training and Learning Results
Ability to build, exploit and manage radio communication systems.	A30
Ability to apply the techniques underlying radio communication systems in fixed and mobile communication services, in local or long-distance links at different bandwidths.	A31
Ability for the selection of antennas and equipment to transmit information by electromagnetic waves.	A34
Knowledge, understanding and ability to handle and fulfill the specific legislation (technical requirements, law ...) in the field of Telecommunications.	A2
Ability to understand the ethical and professional responsibility of the activity of the engineer.	A4

Contents

Topic

1. RADIATION FUNDAMENTALS	1.1 Electromagnetic Fundamentals 1.2 Antenna parameters in transmission 1.3 Antenna parameters in reception 1.4 Types of antennas
2. LINK BUDGET	2.1 Friis transmission equation 2.2 Propagation losses. 2.3 Band frequencies.
3. NOISE	3.1 Thermal noise. 3.2 Noise in antennas. 3.3 Noise factor and noise-equivalent temperature of a receiver.
4. INTERFERENCE	3.1 Concept and types of interference 3.2 Characterization of interference
5. AVAILABILITY	5.1 Concepts of availability, fading and diversity 5.2 Noise-limited Systems 5.3 Interference-limited Systems
6. RADIOWAVE PROPAGATION	6.1 Propagation at very low frequencies 6.2 Surface wave propagation 6.3 Ionospheric propagation 6.4 Tropospheric Propagation

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	14	14	28
Troubleshooting and / or exercises	7	7	14
Laboratory practises	5	10	15
Autonomous practices through ICT	0	8	8
Case studies / analysis of situations	10	40	50
Reports / memories of practice	0	15	15
Troubleshooting and / or exercises	4	8	12
Long answer tests and development	2	6	8

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

Methodologies

	Description
Master Session	Presentation, by the professor, of the contents of the course (theoretical basis, guidelines for solving exercises/problems or developing a radio communication project).
Troubleshooting and / or exercises	Resolution, by the student, of problems and/or exercises related with the course. The student not only has to get the suitable or correct solutions by the application of the theory previously explained but also has to interpret correctly the results.
Laboratory practises	Application of knowledge to specific situations and acquisition of basic skills and procedures in the related field. They are developed in laboratories with specialized equipment.
Autonomous practices through ICT	Application through ICT of the knowledge and the procedural skills that the student has acquired in the course to specific situations.
Case studies / analysis of situations	Study and analysis of problems based on real events in order to know them, think about them, interpret them, generate hypothesis, contrast data ... and train in the use of different procedures of solution.

Personalized attention

Methodologies	Description
Master Session	In this course, students have the opportunity to attend personal tutorials at the time that will be published on the website of the course. In addition, they can also pose all the questions related to Radio Communication field electronically.
Troubleshooting and / or exercises	In this course, students have the opportunity to attend personal tutorials at the time that will be published on the website of the course. In addition, they can also pose all the questions related to Radio Communication field electronically.
Case studies / analysis of situations	In this course, students have the opportunity to attend personal tutorials at the time that will be published on the website of the course. In addition, they can also pose all the questions related to Radio Communication field electronically.
Laboratory practises	In this course, students have the opportunity to attend personal tutorials at the time that will be published on the website of the course. In addition, they can also pose all the questions related to Radio Communication field electronically.

Autonomous practices through ICT	In this course, students have the opportunity to attend personal tutorials at the time that will be published on the website of the course. In addition, they can also pose all the questions related to Radio Communication field electronically.
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Assessment		
	Description	Qualification
Case studies / analysis of situations	Technique that consists of monitoring the student, who will be assessed from his autonomously solving of the proposed tasks (case studies / analysis of situations).	20
Reports / memories of practice	Evaluation of: - the preparation and development of the lab practices - the reports and memories on lab practices	10
Troubleshooting and / or exercises	Two examinations in which the student has to solve a number of exercises by applying the acquired knowledge in the time and conditions established by the professor. The student can take them during the course or together with the final examination, depending on the evaluation system chosen.	40
Long answer tests and development	Final examination: evaluation of the skills acquired by the student. He/she has to develop, relate, organise and present the knowledge acquired in the course.	30

Other comments on the Evaluation

According to the guidelines of the degree, the student can choose between two evaluation systems: continuous assessment or only final examination. Previously to the final examination (or at the entrance of the session), the student will decide the evaluation system. Before performing each task or delivery, the procedure and dates for the review of the qualifications will be published within a reasonable period of time.

1. The continuous assessment includes a series of tasks performed during the course (70%). They are not recoverable, i.e., if a student can not fulfilled them in the time established, the professor is not bound to repeat them. The obtained qualification will be valid only for the current academic course.

The continuous assessment consists of:

- a) two examinations (approximately in the weeks 4 and 9);
- b) delivery (in the last weeks of the course) of memories of the lab and autonomous-ICT practices;
- c) autonomous tasks (case studies / analysis of situations);
- d) the mandatory part of the final examination.

2. FINAL EXAMINATION at the end of the semester: the final examination consists of two parts:

- one part is mandatory for all the students,
- the second one is optional for students who had chosen continuous assessment and mandatory for the rest of students.

The students who had chosen continous assessment can do this part to improve their marks.

FORMULA OF QUALIFICATION

E1=score obtained in the mandatory part of the final examination (up to 10 points).

E2=score obtained in the other part of the final examination (up to 10 points).

PM=score obtained in the lab practices (attendance, quality of the reports...) (up to 10 points).

PEC=score obtained in both exams (continous assessment) (up to 10 points).

S=score obtained in the autonomous tasks (case studies / analysis of situations) (up to 10 points).

Continuous evaluation: $0.3 * E1 + \text{MAX}(0.7 * E2; 0.4 * \text{PEC} + 0.1 * \text{PM} + 0.2 * S)$

No continuous Evaluation: $0.3 * E1 + 0.7 * E2$

4. RECOVERY IN the JULY SESSION. Previously to the exam (or at the entrance of the session) the students choose the evaluation system. The qualification formulas are the same.

5. STUDENTS PRESENTED AT THE COURSE. A student is considered "presented" if he/she receives the final exam or both exercises of the continuous assessment.

Sources of information

Marcos Arias Acuña, Oscar Rubiños López, **Radiocomunicación**, 1ª,
José María Hernando Rábanos, **Transmisión por Radio**, 6ª,
John Griffiths, **Radio Wave Propagation and Antennas. An Introduction**, 1st,
Robert E. Collin, **Antennas and Radiowave Propagation**, 1st,
Thomas A. Milligan, **Modern Antenna Design**, 2nd,
Angel Cardama, L. Jofre, J.M. Rius, S. Balnch, M. Ferrando, **Antenas**, 2ª,
Constantine A. Balanis, **Antenna Theory. Analysis and design**, 3rd,
ITU-R, **Recommendations**,

The first three references are considered as basic. The others are complementary bibliography for specific topics.

Recommendations

Subjects that continue the syllabus

(*)Xestión e certificación radioeléctricas/V05G300V01612
(*)Redes e sistemas sen fíos/V05G300V01615

Subjects that are recommended to be taken simultaneously

(*)Circuitos de radiofrecuencia/V05G300V01511

Subjects that it is recommended to have taken before

(*)Física: Campos e ondas/V05G300V01202
(*)Técnicas de transmisión e recepción de sinais/V05G300V01404
(*)Transmisión electromagnética/V05G300V01303