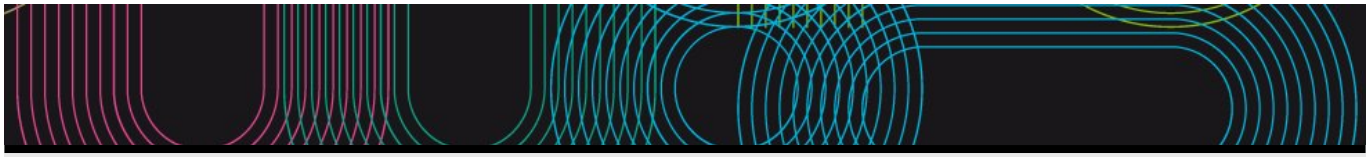

IDENTIFYING DATA				
(*)Transmisión electromagnética				
Subject	(*)Transmisión electromagnética			
Code	V05G300V01303			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Vera Isasa, María			
Lecturers	Aguado Agelet, Fernando Antonio Arias Acuña, Alberto Marcos García-Tuñón Blanca, Inés Gómez Araújo, Marta Lorenzo Rodríguez, María Edita de Rubiños López, José Óscar Vazquez Alejos, Ana Vera Isasa, María			
E-mail	mirentxu@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Fundamentals of electromagnetic guided and unguided transmission. Analysis of the operating principles of different transmission media models and their characterization in telecommunication engineering.			

Competencies	
Code	
A3	CG3: The knowledge of basic subjects and technologies that capacitates the student to learn new methods and technologies, as well as to give him great versatility to confront and update to new situations
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.
A5	CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area.
A17	CE8/T3: The ability to use software tools for bibliographical resources search or information related with electronics and telecommunications.
A18	CE9/T4: The ability to analyze and specify the main parameters of a communications system.
A22	CE13/T8: The ability to understand the electromagnetic and acoustic wave mechanisms of propagation and transmission, and their corresponding receiving and transmitting devices.
A29	CE20/T15: The knowledge of national, European and international telecommunication regulations and laws.

Learning aims	
Expected results from this subject	Training and Learning Results
To understand the mechanisms of propagation and transmission of electromagnetic waves.	A3 A22
To identify and define the main parameters that characterize transmission media of electromagnetic waves.	A3 A17 A18
To solve problems that require the handling of basic concepts related to guided and radio transmission.	A4 A22
To estimate transmission losses in different media.	A3 A5

To measure antenna basic parameters.	A5 A18 A29
To search updated information about specifications and regulations.	A3 A17 A29

Contents	
Topic	
1. Introduction	Types of transmission media, advantages and disadvantages, characterisation.
2. Transmission lines	Getting started with some of the most commonly used transmission lines: coaxial, twisted pair. Circuit model of distributed parameters ,general equations, characteristic parameters (characteristic impedance, propagation velocity, attenuation and phase coefficients). Attenuation, dispersion and crosstalk. Transmission line in circuit (reflection coefficient, standing wave ratio, input impedance). Smith Chart.
3. Waveguides and optical fiber.	Rectangular waveguide: TE and TM modes, cutoff frequency, guided wavelength, wave impedance. Optical fiber: structure, types, numerical aperture, acceptance cone , attenuation and dispersion.
4. Radiowaves and antennas	Characteristics of radiowaves: far field, radiation integral. Antenna concept and fundamental parameters (radiation pattern, secondary lobe level, beamwidth, directivity, gain, polarisation, impedance). Reception: power balance in free space (Friis equation), polarization loss factor. Center feed dipoles. Radiosystems evaluation.
Labs	- Management of software tools to search information: technical, scientific and regulation of telecommunications. - UTP and coaxial. - Basic matching technics. - Radiation pattern plots. - Measurement of basic parameters in transmission lines, waveguides and antennas. - Problem resolution.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	2	4
Master Session	18	27	45
Laboratory practises	21	21	42
Presentations / exhibitions	2	4	6
Autonomous troubleshooting and / or exercises	0	18	18
Systematic observation	9	0	9
Troubleshooting and / or exercises	2	6	8
Multiple choice tests	2	16	18
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	Activities focused to take contact and gather information about the students and to introduce the subject.
Master Session	Presentation by the teacher of the contents of the subject of study (theoretical basis).
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.
Presentations / exhibitions	Student presentation of the results of a group work.
Autonomous troubleshooting and / or exercises	Activity in which problems are formulated related to the subject. The student must develop the analysis and solving problems independently.

Personalized attention	
Methodologies	**Description**
Master Session	Students will have the opportunity to attend personalized tutoring in the schedule that teachers establish for this purpose at the beginning of the course and will be published in the course website. The teacher will resolve in the classroom the doubts that arise in the moment of the class and in the tutoring schedule those that arise when realising the autonomous study.
Autonomous troubleshooting and / or exercises	Students will have the opportunity to attend personalized tutoring in the schedule that teachers establish for this purpose at the beginning of the course and will be published in the course website. The teacher will resolve in the classroom the doubts that arise in the moment of the class and in the tutoring schedule those that arise when realising the autonomous study.

Assessment		
	Description	Qualification
Laboratory practises	Performing lab practices that require instrumentation handling .	20
Presentations / exhibitions	Performing lab practices of software tools to search of information and a work about telecommunication regulation.	10
Systematic observation	Techniques designed to collect data about student participation, based on attendance, laboratory previous preparation and autonomous tasks implementation .	5
Troubleshooting and / or exercises	Proof in which the student has to solve a series of problems in a time and conditions established by the teacher, applying the acquired knowledge	30
Multiple choice tests	Tests for evaluation of acquired skills including direct questions about a particular aspect. Students must respond directly and briefly based on their subject knowledge.	35

Other comments on the Evaluation

Following the guidelines of the degree two evaluation systems will be offered: continuous assessment or final exam.

Continuous assessment includes a series of tasks performed during the course (65%) and a multiple-choice test (35%) performed on date according to the official exam schedule. To participate in this evaluation system is necessary to attend at least to 80% of ordinary class hours and attend the test.

The tasks in the course include the laboratory practices, their corresponding reports and two tests of problem solving (the first scheduled at the middle of the semester and the second by the end). These tasks are not recoverable, ie if a student cannot fulfill on time the teacher has no obligation to repeat it and will only be valid for the academic year in which they are made.

Evaluation by final exam

In addition to the continuous assesment system described above, the student may choose to perform one final exam that will have two parts:

Part I: multiple-choice test (40%).

Part II: Problem Solving (60%).

The students must decide if they choose the ongoing evaluation after the realization of the first test of problem solving on the 8 th - 9 th week of class, in which case they receive a grade that corresponds, independently that they present to other tasks or not.

July exam

It consists of a final exam with the same characteristics and weights as indicated in the previous section.

Students who want to preserve the grade obtained in the first tasks of the continuous assesment (65%) may elect to perform only the first part of the exam (35%).

To pass the subject at least 50% in the total qualification must be obtained in any of the evaluation systems and calls.

Sources of information

F.T. Ulaby, **Fundamentals of Applied Electromagnetics**, 6ª,

S.M. Wentworth, **Applied electromagnetics. Early transmission line approach**, 1ª,

D. K. Cheng, **Fundamentos de electromagnetismo para ingeniería**,

Bibliografía adicional:

B.M. Notaros, **Electromagnetics**, Pearson 2011.

N.N.Rao, **Elements of engineering electromagnetics**,Pearson, 6ª ed., 2004.

J.D. Krauss, **Electromagnetismo con aplicaciones**, McGraw-Hill 2000.

D. K. Cheng. **Field and Wave Electromagnetics**, Addison-Wesley, 2ª ed.,1989.

Recommendations

Subjects that continue the syllabus

(*)Fundamentos de son e imaxe/V05G300V01405
(*)Técnicas de transmisión e recepción de sinais/V05G300V01404
(*)Circuítos de microondas/V05G300V01611
(*)Circuítos de radiofrecuencia/V05G300V01511
(*)Xestión e certificación radioeléctricas/V05G300V01612
(*)Infraestruturas ópticas de telecomunicación/V05G300V01614
(*)Redes e sistemas sen fíos/V05G300V01615
(*)Sistemas de comunicacións por radio/V05G300V01512

Subjects that are recommended to be taken simultaneously

(*)Procesado dixital de sinais/V05G300V01304

Subjects that it is recommended to have taken before

(*)Física: Análise de circuítos lineais/V05G300V01201
(*)Física: Campos e ondas/V05G300V01202
(*)Matemáticas: Cálculo I/V05G300V01105
(*)Matemáticas: Cálculo II/V05G300V01203