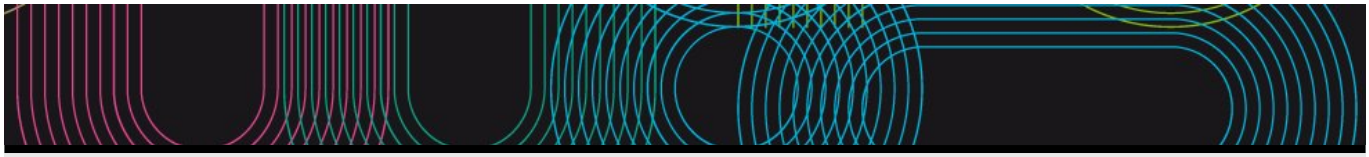

IDENTIFYING DATA				
Electromagnetic Transmission				
Subject	Electromagnetic Transmission			
Code	V05G300V01303			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department	Signal Theory and Communications			
Coordinator	Vera Isasa, María			
Lecturers	García-Tuñón Blanca, Inés Gómez Araújo, Marta Lorenzo Rodríguez, María Edita de Santalla del Río, María Verónica 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	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
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.
B5	CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area.
C8	CE8/T3: The ability to use software tools for bibliographical resources search or information related with electronics and telecommunications.
C9	CE9/T4: The ability to analyze and specify the main parameters of a communications system.
C13	CE13/T8: The ability to understand the electromagnetic and acoustic wave mechanisms of propagation and transmission, and their corresponding receiving and transmitting devices.
C20	CE20/T15: The knowledge of national, European and international telecommunication regulations and laws.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Learning outcomes		
Expected results from this subject		Training and Learning Results
Transmissionm line specification: two-wire line, coaxial wire, coaxial models, twisted pair, optical fibre.	B3	C8 C9
Analysing waves of tension and current and stationary wave.	B5	C9 C13
Proposing impedance matching solutions.	B4	
Crosstalk problems evaluation.	B5	C13

Antenna radiated field calculation and related parameters: radiation pattern, gain, beam-width, impedance, polarisation, effective area.	B5	C9 C13	
Resolving problems of propagation and reception of electromagnetic waves.	B3 B4	C20	D2 D3

Contents	
Topic	
Introduction	Types of transmission media, advantages and disadvantages, characterisation.
Transmission lines	Getting started with some of the most commonly used transmission lines: two-wire, 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.
Waveguides	Transmission modes, cutoff frequency, guided wavelength, wave impedance. Rectangular waveguide.
Optical fiber.	Structure and types. Numerical aperture and acceptance cone. Attenuation and dispersion. Optical sources and receptors.
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. Antenna arrays.
Labs	- Management of software tools to search information: technical, scientific and regulation of telecommunications. - Measurement and analysis of voltage and current waves and standing waves. - Optical fiber transmission fundamentals. - Basic impedance matching technics. - Radiation pattern plots. - Measurement of antenna basic parameters. - Problem resolution.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	18	27	45
Autonomous problem solving	7	28	35
Laboratory practices	10	2	12
Computer practices	8	2	10
Classroom jobs	8	16	24
Problem solving	3	12	15
Objective questions exam	1	7	8
*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 get information about the students and to introduce the subject.
Lecturing	Presentation by the teacher of the contents of the subject of study (theoretical basis). Through this methodology the competencies CG3, CE9,CE13,CE20 and CT2 are developed.
Autonomous problem solving	Activity in which problems are formulated related to the subject. The student must develop the analysis and solving problems independently. The solutions are provided in ordinary class hours. Through this methodology the competencies CG4, CE9 and CE13 are developed.
Laboratory practices	Application of knowledge to specific situations and acquisition of basic skills and procedures. They are developed in laboratories with specialized equipment. Through this methodology the competencies CG5 and CT3 are developed.

Computer practices	Activities of acquisition of basic skills related with the matter. Through this methodology the competencies CG3, CE8, CE20 and CT3 are developed.
Classroom jobs	Activities of acquisition and handle of technics and tools related with the matter. Through this methodology the competencies CG3 and CG4 are developed.

Personalized attention

Methodologies	Description
Lecturing	In the tutorial schedule, teaching staff will attend the needs and queries of the students related with the study of the subject.
Laboratory practices	The teaching staff will set the time of the session and will resolve the questions about the practical implementation.
Autonomous problem solving	In the tutorial schedule, teaching staff will attend the needs and queries of the students related with the study of the subject.
Computer practices	The teaching staff will set the time of the session and will resolve the questions about the practical implementation.
Classroom jobs	The teaching staff will set the time of the session and will resolve the questions about the practical implementation.

Assessment

	Description	Qualification	Training and Learning Results	
Classroom jobs	Short checks (see other comments)	25	B4 B5	C8 C20
Problem solving	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.	40	B3 B4	C9 C13
Objective questions exam	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	B3	C9 C13

Other comments on the Evaluation

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

Continuous assessment

Continuous assessment includes the following tasks:

- Classroom work (25%): four short checks carried out during practical hours.

- Test (35%): two quizzes (25% + 10%).

- Problem solving (40%): two exams, 20% weight each one.

The time schedule of these tasks, approved by the CAG, will be available at the beginning of the semester.

These tasks are **not recoverable**, ie if a student cannot fulfill on time the teacher has no obligation to repeat them and will **only be valid for the academic year in which they are made**.

To pass the subject by this evaluation system, 1/3 of the maximum score of each item in the above table must be obtained and 50% minimum of the global score (sum of the three blocks) must be reached.

After the first problem solving exam the student must decide between the continuous assesment or the single assesment modes of evaluation, in which case they receive a grade, independently that they present to other tasks or not. Failure to submit to this test implies that the evaluation choice is single assessment. If the minimum grade required is not obtained in any of the three different tasks defined, the final grade will never be higher than 4.5

Single assessment

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

- Part I: test on measurement practices (10%) and information search exercise (5%).

- Part II: questions (35%).

- Part III: problem solving (50%).

Second chance

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

Students who have opted for the continuous assessment system may keep the grade (classroom work, test or problem) in which they have exceeded the required minimum. In this case, the same weighting indicated in the continuous assessment section is maintained.

Extraordinary call (end of career)

The system described in the single assessment section will be applied.

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

Sources of information

Basic Bibliography

F.T. Ulaby, **Fundamentals of Applied Electromagnetics**, 7ª,
S.M. Wentworth, **Applied electromagnetics. Early transmission line approach**, 1ª,
D. K. Cheng, **Fundamentos de electromagnetismo para ingeniería**,

Complementary Bibliography

B.M. Notaros, **Electromagnetics**, Pearson, 2011
N.N.Rao, **Elements of engineering electromagnetics**, 6ª, Pearson, 2004
J.D. Krauss, **Electromagnetismo con aplicaciones**, McGraw-Hill, 2000
D. K. Cheng, **Field and Wave Electromagnetics**, 2ª, Addison-Wesley, 1989

Recommendations

Subjects that continue the syllabus

Fundamentals of Sound and Image/V05G300V01405
Signal Transmission and Reception Techniques/V05G300V01404
Microwave Circuits/V05G300V01611
Radio Frequency Circuits/V05G300V01511
Optical Telecommunication Infrastructures/V05G300V01614
Wireless Systems and Networks/V05G300V01615
Radio Communication Systems/V05G300V01512

Subjects that are recommended to be taken simultaneously

Digital Signal Processing/V05G300V01304

Subjects that it is recommended to have taken before

Physics: Analysis of Linear Circuits/V05G300V01201
Physics: Fields and Waves/V05G300V01202
Mathematics: Calculus 1/V05G300V01105
Mathematics: Calculus 2/V05G300V01203