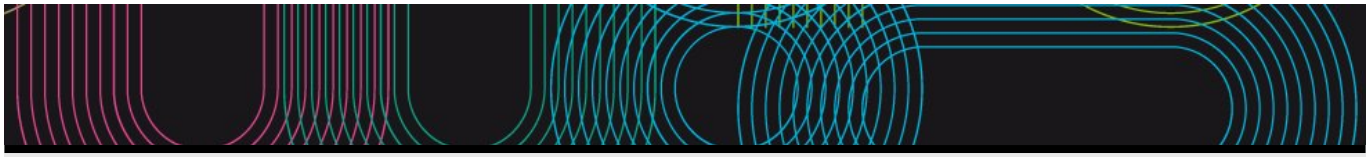

IDENTIFYING DATA				
Electromagnetic Transmission				
Subject	Electromagnetic Transmission			
Code	V05G301V01207			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Vera Isasa, María Lorenzo Rodríguez, María Edita de			
Lecturers	Gómez Araújo, Marta Lorenzo Rodríguez, María Edita de Santalla del Río, María Verónica Vazquez Alejos, Ana Vera Isasa, María			
E-mail	mveraisasa@uvigo.es edita.delorenzo@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. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

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.
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.
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	C9
Tension and current waves, E-H fields and stationary wave analysis.	B5	C13
Proposing impedance matching solutions.	B4	
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	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 cable, 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 a 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 receivers.
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	- 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 practical	20	4	24
Problem solving	6	18	24
Problem and/or exercise solving	3	9	12
Objective questions exam	1	8	9
*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 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 practical	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.
Problem solving	Activity in which problems are formulated related to the subject. The student must develop the analysis and solving problems with the advisor help. Through this methodology the competencies CG4, CE9 and CE13 are developed.

Personalized assistance

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 practical	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.
Problem solving	In the tutorial schedule, teaching staff will attend the needs and queries of the students related with the study of the subject.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise 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.	75	B3 B4	C9 C13
Objective questions exam	Proofs of short length (see other comments)	25	B3 B5	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 (with its weight in the final grade):

- T1: Exercises of decibels (5%).
- T2: Problems of transmission lines (30%).
- T3: Questions/short exercises about guided transmission (15%).
- T4: Questions/short exercises about radiotransmission (10%).
- T5: Problems of radiotransmission (40%).

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 they are **valid only for the academic year in which they are made**.

To pass the subject by this assesment system, it is necessary to obtain 30% of the maximum qualification in each one of the following thematic blocks:

Guided transmission: T1 + T2 + T3.

Radiotransmission: T4 + T5

If the minimum 30% required is not obtained in any of the blocks defined, the final mark will never be higher than 4.5

After the first problem solving exam the student must decide between continuous assesment or single assesment, in which case they receive a mark, independently that they assist or not to the other tasks. A failure to attend to this test implies that the choice is single assessment.

Exam-only assessment

In addition to the continuous assessment described above, the student may choose to perform one final exam with two parts:

- Part I: questions/short exercises (30%).

- Part II: problem solving (70%).

Second call

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

Students who have chosen continuous assessment may keep the mark of one of the thematic blocks (guided or radio transmission) if it has exceeded the required minimum.

End-of-program call

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

Copy

In case of detecting any student copying or not respecting the instructions of any of the evaluation tests, he/she will be urged to leave the classroom/laboratory, the final grade will be FAIL (0 points), and this incident will be reported to the corresponding academic authorities to take the appropriate consecuences.

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

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

Microwave Circuits/V05G300V01611
Radio Frequency Circuits/V05G300V01511
Optical Telecommunication Infrastructures/V05G300V01614
Wireless Systems and Networks/V05G300V01615
Radio Communication Systems/V05G300V01512

Subjects that it is recommended to have taken before

Mathematics: Calculus 1/V05G301V01101
Mathematics: Calculus 2/V05G301V01106
Physics: Fields and Waves/V05G301V01202

Contingency plan

Description

In case that the teaching must be totally on-line:
- The teaching of A groups will be done synchronously using Campus Remoto.
- The teaching of B groups will be done synchronously using Campus Remoto if possible. The lab practices will be replaced by other that can be done remotely.
- The assessment will be done using FaiTic + Campus Remoto . The number, date and weight of the tasks will be the same.