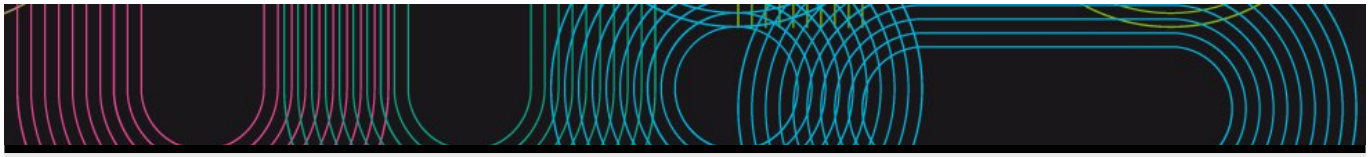

IDENTIFYING DATA				
Physics: Fields and Waves				
Subject	Physics: Fields and Waves			
Code	V05G300V01202			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	García Pino, Antonio			
Lecturers	Fraile Peláez, Francisco Javier García Pino, Antonio García-Tuñón Blanca, Inés Gómez Araújo, Marta Obelleiro Basteiro, Fernando Rubiños López, José Óscar			
E-mail	agpino@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Fields and Waves presents the first contact the student's degree with the phenomena of electromagnetic wave, which is the physical transmission of information. mathematical modeling of electromagnetic fields that provide insights into the behavior of electromagnetic waves in real environments will be introduced.			

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
A10	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial derivatives equations; numerical methods, numerical algorithms, statistics and optimization
A12	CE3/FB3: Comprehension and command of basic concepts about the general laws of mechanics, thermodynamics, electromagnetic fields and waves and electromagnetism and their application to solve Engineering problems.

Learning aims	
Expected results from this subject	Training and Learning Results
Understanding and mastery of the general laws of fields and waves	A12
Knowledge of basic topics and technologies, enabling students to learn new methods and technologies, as well as endowed with the versatility to adapt to new situations.	A3
Ability to solve math problems that may arise in engineering: Ability to apply knowledge of linear algebra, geometry and differential geometry.	A10
Ability to solve math problems that may arise in engineering: Ability to apply knowledge of differential and partial-differential equations	A10

Contents	
Topic	
1. Vector and differential analysis of fields	1.1 Scalar and vector fields 1.2 Systems of coordinates in space 1.3 Vector Algebra 1.4 Integral Operators 1.5 Differential operators 1.6 Properties of operators

2. Electrostatic fields	2.1 Sources of the electrostatic field 2.2 Equations of the electrostatic field, electric potential 2.3 Electrostatic fields produced by charge distributions 2.4 Electrostatic field in material media 2.5 Equations of Poisson and Laplace
3. Magnetostatic fields	3.1 Sources of magnetostatic field 3.2 Magnetostatic field equations 3.3 Magnetostatic field produced by current distributions
4. Fields in material media	4.1 Electrostatic field in material media 4.2 Magnetostatic field in material media
5. Maxwell Model	5.1 Maxwell's equations in integral form 5.2 Differential form of Maxwell's equations 5.3 Boundary conditions. 5.4 Energy balance of the electromagnetic field 5.5 Harmonic time variation 5.6 Harmonic time variation in material media
6. Wave equation and its solutions	6.1 Introduction. 6.2 Wave equation for time harmonic fields 6.3 Propagation, attenuation and phase constants 6.4 Solutions in rectangular coordinates 6.5 Progressive, stationary and evanescent waves in lossy and losseless media
7. Uniform plane waves	7.1 Expressions of the fields 7.2 Characteristic impedance 7.3 Poynting Vector 7.4 Time domain fields 7.5 Polarization
8. Wave reflection and transmission	8.1 Reflection and transmission coefficients 8.2 Standing waves 8.3 Polarization and power

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	25	37.5	62.5
Case studies / analysis of situations	13	18	31
Troubleshooting and / or exercises	13	19.5	32.5
Troubleshooting and / or exercises	3	9	12
Long answer tests and development	2	10	12

*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	Exhibition by the professor of the contents on the matter object of study, theoretical bases and/or guidelines of a work, exercise or project to develop by the student.
Case studies / analysis of situations	Analysis of a fact, problem or real event with the purpose to know it, interpret it, resolve it, generate hypothesis, contrast data, think about it, complete knowledges, diagnose it and train in alternative procedures of solution.
Troubleshooting and / or exercises	Problems and/or exercises related with the subject are formulated. The student has to develop the suitable or correct solutions by development of routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results. I complement of the lectures.

Personalized attention

Methodologies	Description
Master Session	The students will have occasion of atend to personalized tutorial sessions in the officce of the professor during the schedule established for that at the begining of the course. The schedule will be published in the web page of the subject. Students will be able to also pose his queries by e-mail.
Troubleshooting and / or exercises	The students will have occasion of atend to personalized tutorial sessions in the officce of the professor during the schedule established for that at the begining of the course. The schedule will be published in the web page of the subject. Students will be able to also pose his queries by e-mail.

Case studies / analysis of situations	The students will have occasion of atend to personalized tutorial sessions in the officce of the professor during the schedule established for that at the begining of the course. The schedule will be published in the web page of the subject. Students will be able to also pose his queries by e-mail.

Assessment

	Description	Qualification
Troubleshooting and / or exercises	Proof in which the students have to solve series of problems and/or exercises in a time/condition established by the professor. In this way, the students have to apply their knowledge. In this proof the skills A10 and A12 are assessed	60
Long answer tests and development	Final examination: Proof for evaluation of the skills that includes open questions on a subject. The students have to develop, relate, organise and present their knowledge about the subject in an extensive answer. In this proof the skills A3, A10 and A12 are assessed	40

Other comments on the Evaluation

Following the guidelines of the studies, two systems of evaluation will be offered to the students enrolled in this subject: either continuous evaluation or evaluation at the end of the semester. Criteria for both are detailed below.

1. CONTINUOUS EVALUATION.

- The student that receive it this system of evaluation will be able to achieve a maximum grade of 6 points.
- The students must complete three evauable tasks. The preliminary schedule and the weight of each task in the final grade are:
    - Task 1. Week 4 (approximately). Topic 1. Weight 10%. EC1 up to 1p.
    - Task 2. Week 8 (approximately). Topics 2 to 4. Weight 20%. EC2 up to 2p.
    - Task 3. Week 12(approximately). Topics 5 and 6. Weight 30%. EC3 up to 3p.
- The date and review procedure of the obtained marks will be officially communicated before the completion or delivery of eac task. Students will have the opportunity to be informed about the status of each task and review their evaluation within a reasonable period of time.
- The task are not recoverable. If a student cannot fulfilled them in the stipulated term, the professor is not bound to repeat them.
- The qualification for students who opt for continuous evaluation (EC) will be calculate as the sum of the obtained marks in the three tasks: EC=EC1+EC2+EC3.
- The obtained qualification (EC) will be valid only for the current academic course.
- It will be considerer that a student follows this continuous evaluation system when after completing the first task the student carries out the second task.

2. FINAL EVALUATION AT THE END OF SEMESTER.

- This procedure will consist in a final examination that includes the contents developed in the classes of theory and practice.
- This exam will be mandatory for all students. There are three cases:
    - For students that do not opt by the continuous evaluation points reached in it (among 0 and 10) will be the final grade.
    - Students doing the continuous evaluation: they are graded with the points obtained in the evaluation follow the next:
        - The part of the exam corresponding to topics 7 and 8 is mandatory for all of them. (Score EC4 up to 4p.)
        - If (EC1+EC2) is less than 1, the part of the exam corresponding to topics 1 to 4 is mandatoty. In other case thay can take this part to improve the sum (EC1+EC2)
        - If EC3 is less than 1, the part of the exam corresponding to topics 5 and 6 4 is mandatoty. In other case thay can take this part to improve the sum EC3
        - The final score is EF=(EC1+EC2)+EC3+EC4

3. RETAKE IN THE JULY SESSION.

- It will consists on a final examination as the aforementioned.
- For students in continuous evaluation, the exam is divided in three parts corresponding to the qualifications (EC1+EC2), EC3 and EC4. Students will take necessarily the parts of the exam with qualification less than 1. Optionally they will be able to take the rest in order to improve the corresponding qualification. The final qualification will be EF=(EC1+EC2)+EC3+EC4.

ADITIONAL COMMENTS:

- It will be considered as presented every student that receives any of the two final exams or two of the exercicies of continuous evaluation.
- If a student has participated in the continuous evaluation and does not pass the course he/she will be considered as presented and will receive a grade of fail, regardless of he/she takes the final exam or not.
- The subject is considered passed if the final grade obtained is equal or greater than 5p.

Sources of information

Basic:

Fundamentos de Electromagnetismo para Ingeniería, D.K. Cheng. Ed. Addison Wesley, 1998. (o su versión original en inglés: Fundamentals of Engineering Electromegnetics, D.K.Cheng, Ed. Addison Wesley 1993)

Campos electromagnéticos, F. Dios, D. Artigas et all. Ediciones UPC. 1998.

Fundamentos de la Teoría Electromagnética, J.R. Reitz, F.J. Milford, R.W. Christy, Ed. Addison Wesley, 1996

Complementary:

Field and Wave Electromagnetic, D.K. Cheng, 2ª edición, Ed.Addison-Wesley. 1989.

Electromagnetic Waves, U.S. Inam y A.S. Inan. Ed. Prentice Hall. 2000.

Teoría Electromagnética, 7ª Ed. W.H. Hayt Jr., J.A.Buck. Ed. Mc Graw Hill, 2006.

Ondas Planas, J.E. Page, C. Camacho. Serv. Pub. ETSIT Madrid. 1983.

Electromagnetic Fields and Waves, M. F. Iskander. Ed. Prentice Hall. 1992.

Problemas de campos electromagnéticos. Serv. Pub. ETSIT Madrid. 2001.

Recommendations

Subjects that continue the syllabus

Electromagnetic Transmission/V05G300V01303

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus II/V05G300V01203

Subjects that it is recommended to have taken before

Mathematics: Linear Algebra/V05G300V01104
Mathematics: Calculus I/V05G300V01105