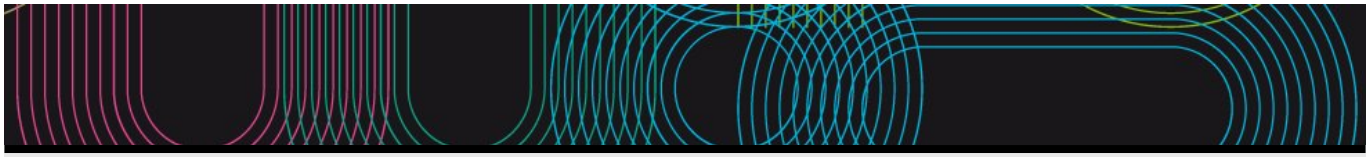

IDENTIFYING DATA				
Physics: Analysis of Linear Circuits				
Subject	Physics: Analysis of Linear Circuits			
Code	V05G300V01201			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	García-Tuñón Blanca, Inés			
Lecturers	Díaz Otero, Francisco Javier García-Tuñón Blanca, Inés Gómez Araújo, Marta Prol Rodríguez, Miguel Sánchez Sánchez, Enrique			
E-mail	inesgt@com.uvigo.es			
Web	http://www.faitic.uvigo.es			
General description	The course introduces the fundamentals of the lumped circuit principles and abstractions on which the design of electronic systems is based. These include lumped circuit models for sources, resistors, inductors, and capacitors. It intends to present some techniques to analyze (to determine currents and voltages) such systems: conventional analysis (integer-differential analysis, phasors and impedances in sinusoidal regime) and linear systems theory based analysis (by using the Laplace and Fourier transforms).			

Competencies	
Code	
B3	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
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.
C4	CE4/FB4: Comprehension and command of basic concepts in linear systems and their related functions and transforms; electric circuits theory, electronic circuits, physical principles of semiconductors and logical families, electronic and photonic devices, materials technology and their application to solve Engineering problems.
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		
To know the elements and laws involved in lumped circuit analysis.		C4	
To show the ability to analyse linear circuits in different circumstances: -. to know how to choose among different alternatives when solving a problem. -. to know simplifying techniques, their constraints, and how to decide which ones must be used.	B4	C4	D2
To translate the time domain into the transformed domains, by using transforms basic concepts.		C4	
To be able to qualitatively justify the role played by circuit elements and their interactions.	B3	C4	D3
To master the language and symbolism of the discipline	B3	C4	D3

Contents

Topic	
I: Introduction	Fundamental and derived magnitudes. Active and passive elements and their functional relationships. Kirchhoff's laws. Simplifying techniques; Thévenin and Norton equivalent circuits. Analysis by the technique of mesh voltages. Analysis by the techniques of node currents.
II: Transient Response	Transient and steady-state regimes. Transient regime origin. Conditions of study (transient between two steady-state continuous regimes, two reactive elements as a maximum). Inductors and capacitors in steady-state continuous regime. Single reactive element networks: time expression, time constant. Two reactive elements networks: types of responses, time expressions, damping coefficient, angular resonant frequency. Networks changing in several time values. Partially coupled elements networks.
III: Steady-state sinusoidal response	Definition and parameters. Concepts of phasor and impedance. Mesh and node analysis of steady-state sinusoidal regime networks. Autoinductance and mutual inductance. Linear and ideal transformers. Power expressions: instantaneous power, complex power, average power, reactive power. Thévenin and Norton equivalent circuits. Frequency response. Using the superposition principle.
IV: Two-ports	Definition of a two-port circuit. Characteristic parameters. Sets of characteristic parameters. Characteristic parameters determination. Combining two-ports. A two-port in a circuit.
V: Signals and systems	lasses of signals. Some relevant signals: step function, unit impulse function, exponential function, sinusoidal function. Classes of systems. System properties; linear, time invariant systems; response to impulse.
VI: Laplace transform	Definition. Direct transforms. Inverse transform determination. Application to linear circuits. The transference function. Steady-state response in a circuit. Response for a sinusoidal input. Application of the superposition principle.
VII: Fourier transform	Fourier series expansion. Expressions of Fourier series expansion. Amplitude and phase spectra. Frequency response. Fourier transform. Fourier transform expressions. Properties: linearity, simmetry, time displacement, time/frequency scaling, modulation.
VIII: Filters.	Filter concept. Filter classes. Ideal and real filters. Low pass prototype based design. Filter responses.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Master Session	27	54	81
Practice in computer rooms	16	16	32
Laboratory practises	3	3	6
Troubleshooting and / or exercises	3	9	12

Practical tests, real task execution and / or simulated.	4	8	12
Long answer tests and development	2	4	6

*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	Presentation of the course: syllabus, bibliography, teaching methodology, and assessment and grading procedures. Through this methodology the competencies CT2 and CT3 are developed.
Master Session	The goal of this methodology is the presentation of the theoretical contents and the practical assessment about students learning abilities. Different exercises and problems related to the specific subject will be solved during these sessions, by the Professor or the students with his/her support, either individually or working in a group. Through this methodology the competencies CG3, CG4, CE4, CT2 and CT3 are developed.
Practice in computer rooms	PSpice and Matlab will be used to solve exercises of circuit simulation in 8 2-hour sessions (16 hours in total). Theses sessions will start with supervised either individual or team problem solving of practical applications related to the theoretical content of the subject. The solutions will be analyzed, checked and compared using the computational tools aforementioned. Through this methodology the competencies CG3, CG4 and CE4 are developed.
Laboratory practises	Two practical sessions will be carried out in the hardware lab, assembling and measuring circuits tasks will be covered. A total of 4 hours, with 1 hours dedicated to the evaluation of these sessions. Through this methodology the competencies CG3, CG4 and CE4 are developed.

Personalized attention

Methodologies	Description
Master Session	Personal attention will be carried out under student demand, at the professor room and/or at the laboratories, during the time schedules established and posted by the instructors at the beginning of the course.
Laboratory practises	Personal attention will be carried out under student demand, at the professor room and/or at the laboratories, during the time schedules established and posted by the instructors at the beginning of the course.
Practice in computer rooms	Personal attention will be carried out under student demand, at the professor room and/or at the laboratories, during the time schedules established and posted by the instructors at the beginning of the course.

Assessment

	Description	Qualification	Training and Learning Results
Troubleshooting and / or exercises	These tests will also take place in Group B timetable, along with the practical tests and circuit simulation. So they are expected to be carried out in week 5 (EC1 Chapters 1 and 2), 9 (EC2 Chapters 3 and 4) and 15 (EC3 Chapters 5 to 8). The punctuation of each of these tests will be: 1.5, 2.5 and 2.0 points respectively. Each tests is related to one or two of the most important chapters of the subject. Each tests will consist on two or more exercise or questions.	60	B3 C4 B4

Practical tests, real task execution and / or simulated.	The following tasks/tests will be carried out in Group B timetable. There will be 4 tests/tasks during the semester: 1. Test in PCs lab: 3 tests related to circuit simulation exercises, using PSPICE and Matlab. These tests will be carried out jointly with problem solving and/or other exercises, to be expected in week 5 (EC1 Chapters 1 and 2), 9 (EC2 Chapters 3 and 4) and 15 (EC3 Chapters 5 and 6). The punctuation of each of these tests will be 0.5, 1.0 and 1.0 respectively. 2. Tests in lab 1: test related to assembling and measuring circuits. This test is expected to be carried out in week 11 with a maximum punctuation of 1.5 points. The following skills will be evaluated: teamwork, fit to design specifications and presenting results.	40	B3 B4	C4
Long answer tests and development	Additionally to the continuous evaluation system based on the results achieved on the aforementioned tests, the students will have the option of a final examination.	0	B3 B4	C4

Other comments on the Evaluation

The student, in agreement to the official academic-year schedule, will have two opportunities during the academic year to pass the course.

1. First opportunity at the end of the semester (end of semester). The student is free to choose the continuous evaluation system above described, without excluding the possibility to do a final exam. Possible cases:

- Students only doing the continuous evaluation: they are graded with the points obtained in the evaluation.
- Students doing both the continuous evaluation and the exam: they are graded with the best of both qualifications.
- Students only doing the final exam: they are graded with the points obtained in the exam.

Details of the final examination: The final exam will have three parts, each of them corresponding to each of the tests related to problem solving and/or exercises carried out during the continuous evaluation: EC1 (Chapters I and II), EC2 (Chapters III and IV) and EC3 (Chapters V to VIII). The students will be able to choose to do the full exam or only those parts that they wish to improve the grade obtained during continuous evaluation.

2. Extraordinary exam. Students that do not reach the minimum grade at the end of the semester will have the option to do a final extraordinary exam of the full content of the subject, theory and practice. The extraordinary exam can include test type and/or reasoning questions, problem solving and/or exercises, as well as the development of practical cases. The maximum punctuation achieved on this exam (between 0 and 10) will be the final grade. It will replace the grade obtained during continuous evaluation (sum of the grades obtained during tests and final exam)

Additional comments:

- The continuous evaluation tests will take place in group B, so the students must attend to the group assigned at the beginning of the semester.
- Doing 2 or more tests and/or the final exams will prevent the student to get the "Not presented" mark.
- The average grade during continuous evaluation will only be valid only for the corresponding academic year.
- It will be considered that the subject has been passed if the final grade is equal or above 5.

Re-scheduling of tests. In case of missing a test, instructors have not any compulsion to rescheduling.

Test results. Before each test, the date and revision procedure of assigned grading marks will be indicated. Such dates will imply a reasonable delay (in general, not greater than three weeks) between the date of test and the release of the grading marks.

Sources of information

James W. Nilsson, **Electric Circuits**,

Enrique Sánchez, Carmen García Mateo, **Material docente**, Página web,

J.H. McClellan, R.W. Schafer, M.A. Yoder, **Signal Processing First**,

J. W. Nilsson's book will be the basic course reference. It is a book covering all the course content in more extension and by using a very clear language. It includes a number of exercises, both proposed and solved. A number of editions are available, in general with little differences among them. It is recommended to the students to use the English editions.

Additionally, the students will have available in the course web site some teaching material (extended lectures notes, practice handbooks, exam examples).

McClellan et al. book is mentioned as a complementary reference, specially indicated for signal processing and filtering lessons. This book will be used in a second year course devoted to digital signal processing.

Recommendations

Subjects that continue the syllabus

Physics: Fundamentals of Electronics/V05G300V01305
Digital Signal Processing/V05G300V01304
Signal Transmission and Reception Techniques/V05G300V01404
Microwave Circuits/V05G300V01611
Radio Frequency Circuits/V05G300V01511
Analogue Electronics/V05G300V01624
Engineering of Electronic Equipment/V05G300V01523

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

Other comments

It is strongly recommended that students are familiar with complex numbers, trigonometric functions, linear equation system solving, elemental function derivatives and computation of simple integrals.