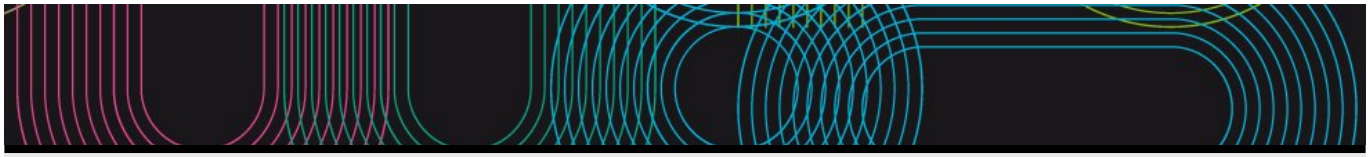

IDENTIFYING DATA				
Physics: Analysis of Linear Circuits				
Subject	Physics: Analysis of Linear Circuits			
Code	V05G300V01201			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Sánchez Sánchez, Enrique			
Lecturers	Díaz Otero, Francisco Javier García Mateo, Carmen García-Tuñón Blanca, Inés Gómez Araújo, Marta Prol Rodríguez, Miguel Sánchez Sánchez, Enrique			
E-mail	enrique.sanchez@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	
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.
A13	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.

Learning aims	
Expected results from this subject	Training and Learning Results
To know the elements and laws involved in lumped circuit analysis.	A13
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.	A4 A13
To translate the time domain into the transformed domains, by using transforms basic concepts.	A13
To be able to qualitatively justify the role played by circuit elements and their interactions.	A3 A13
To master the language and symbolism of the discipline	A3

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	24	48	72
Laboratory practises	21	21	42
Forum Index	0	5	5
Troubleshooting and / or exercises	5	15	20

Practical tests, real task execution and / or simulated.	5	5	10

*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.
Master Session	The goal of this methodology is the presentation of the theoretical contents and the practical assessment about students learning abilities. In 3 of these sessions, written quizzes will be conducted of 55 minutes each as a maximum.
Laboratory practises	Circuit simulation exercises will be done by using PSpice and Matlab software packages for 20 hours (in 3 of them evaluatiin exercices will be conducted). During 6 additional hours circuit implementation and measurement tasks will be done, with two evaluation exercises.
Forum Index	The course web site is hosted in UVIGO e-learning platform (http://faitic.uvigo.es). It includes all the information related to the course. Forums for ideas interchanging and comments will be available.

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. Additionally, discussion forums at the web site will be used as communication channel between instructors and students.
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. Additionally, discussion forums at the web site will be used as communication channel between instructors and students.
Forum Index	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. Additionally, discussion forums at the web site will be used as communication channel between instructors and students.

Assessment

	Description	Qualification
Troubleshooting and / or exercises	3 exercises to be done during the time schedule for lecture sessions. Each one is referred to one or two of the most relevant topics in the course. Each exercise consists of two or more questions. Maximum qualifications of 1, 2, and 2.5 points will be assigned, respectively. Capabilities A4 and A13 are evaluated by means of these tests.	55
Practical tests, real task execution and / or simulated.	5 evaluation exercises will be done along the semester. They will be conducted in medium-size groups. 3 of them will concern circuit simulation, 0.75, 1 and 1.25 points, respectively, being assigned. The 2 remaining exercises will refer to circuit implementing and testing (with maximum qualifications of 0.5 and 1 points, respectively). In these exercises skills concerning join work will be evaluated. Capabilities A3 and A13 are evaluated by means of these tests.	45

Other comments on the Evaluation

Additionally to the evaluation system above described, the student may choose to do a final exam. This exam will have the same characteristics than exercises named "Solving problems and/or exercises ", being evaluated among 0 and 10 points.

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.

2. Extraordinary exam. Students not passing the course at the end of the semester may do a final exam like the aforementioned. Points reached in it (among 0 and 10) will be the final grade.

Additional comment: Doing 4 or more tests and/or the final exams will prevent the student to get the "Not presented" mark.

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.