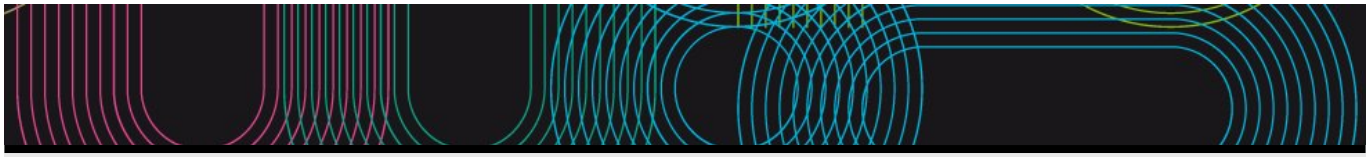

IDENTIFYING DATA

Physics: Analysis of Linear Circuits

Subject	Physics: Analysis of Linear Circuits			
Code	V05G301V01108			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	García-Tuñón Blanca, Inés			
Lecturers	García Mateo, Carmen García-Tuñón Blanca, Inés Gómez Araújo, Marta Pérez Eijo, Lorena María			
E-mail	inesgt@com.uvigo.es			
Web	http://moovi.uvigo.gal			
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 transform). English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

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.
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.

Expected results from this subject

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
Handle with solvency the language and symbolism of the discipline.	B3 B4	C4	

Contents	
Topic	
I: Introduction to the circuit analysis	Fundamental and derived magnitudes. Circuit elements. Kirchhoff's laws. Resistors in series. Resistor in parallel. Divider circuits: voltage-divider and current-divider.
II: Techniques of circuit analysis in steady-state continuous regime.	Analysis by the mesh current method. Analysis by the node voltage method. Source transformations. Thévenin and Norton equivalent circuits. Maximum power transfer. Superposition.
III: Reactive elements	Inductors and capacitors. Series-parallel combinations of inductors and capacitors. Inductors and capacitors in steady-state continuous regime. Transient regime. Natural and step response of RL and RC circuits.
IV: Sinusoidal steady-state analysis	Definition and parameters. Rms and medium value. Concepts of phasor and impedance. Mesh and node analysis of steady-state sinusoidal regime networks. Thévenin and Norton equivalent circuits. Ideal transformers. Power expressions and calculations.
V: Two-port circuits	Definition of a two-port circuit. Characteristic parameters. Interconnected two-port circuits. Analysis of the terminated two-port circuit.
VI: Circuit analysis in the transformed domain	Steady-state response in a circuit. The transfer function. Circuit elements in the s domain. Circuit analysis in the s domain.
VII: Frequency selective circuits	Filter concept. Low-pass filters. High-pass filters. Bandpass filters. Bandreject filters.
VIII: Circuit analysis in the time domain	Classification of signals. Classification of systems. Linear and time invariant systems. Direct and inverse Laplace Transform. Poles and zeros diagram. Response to impulse. Convolution integral.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Lecturing	24.5	49	73.5
Practices through ICT	12	12	24
Laboratory practical	8	4	12
Problem solving	9	4	13
Problem and/or exercise solving	3	9	12
Systematic observation	1	2	3
Essay questions exam	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
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.

Lecturing	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.
Practices through ICT	Theses sessions will consist on a supervised either individual or team problem solving of practical applications related to the theoretical content of the subject. The solutions could be analyzed, checked and compared using computational tools. Through this methodology the competencies CG3, CG4 and CE4 are developed.
Laboratory practical	Practical sessions will be carried out in the hardware lab, assembling and measuring circuits tasks will be covered. Through this methodology the competencies CG3, CG4 and CE4 are developed.
Problem solving	Theses sessions will consist on a supervised team problem solving of practical applications related to the theoretical content of the subject. Through this methodology the competencies CG3, CG4 and CE4 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Needs and study matter queries of students will be address by the professors on tutoring hours (avaliables at ttps://moovi.uvigo.gal).
Laboratory practical	Professors set the pace of the session and resolve any questions that arise during the realization of practice. Also on the schedule tutoring (avaliable at ttps://moovi.uvigo.gal)., professors address the needs and queries of the students related to laboratory practices.
Practices through ICT	Professors set the pace of the session and resolve any questions that arise during the realization of practice. Also on the schedule tutoring (avaliable at ttps://moovi.uvigo.gal)., professors address the needs and queries of the students related to practices in computer rooms.
Problem solving	Professors set the pace of the session and resolve any questions that arise during the session. Also on the schedule tutoring (avaliable at ttps://moovi.uvigo.gal)., professors address the needs and queries of the students related to problem solving.

Assessment

	Description	Qualification	Training and Learning Results
Problem and/or exercise solving	There will be 3 tests in Group A schedule: ECA1, ECA2 and ECA3. The score of each of these three tests will be 2 points. The schedule of the tests will be approved in the CAG and will be available at the beginning of the semester.	60	B3 C4 B4
Systematic observation	Throughout the course, at the end of different practical sessions (practices through ICT and laboratory practices), the subject's teaching staff will propose the resolution of some simple exercises related to the content of the session and previous sessions. Students who participate in the continuous evaluation and solve these exercises may receive a total bonus of up to 0.5 points (Bonus). The bonus received will be added to the final continuous evaluation grade and if the maximum possible grade is exceeded, the final continuous evaluation grade would be truncated by 10.	5	B3 C4 D2 B4 D3
Essay questions exam	Global Test (PG). It will cover all the contents of the subject, both theoretical and practical, and may include multiple choice tests, reasoning questions, problem solving and / or exercises, as well as the development of practical cases. There will be a version of this exam for students who follow the continuous assessment, whose maximum score will be 4 points, and another extended version of it with a score of 10 points for the rest of the students.	40	B3 C4 B4

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. Ordinary exam at the end of the semester.

Students can freely choose the continuous assessment system described in the previous section, without this excluding the possibility of taking a final exam.

Possible cases:

- Students who only take the final exam: they are graded with the score they have obtained in it (0 to 10 points).
- Students who follow the continuous assessment: they are qualified with the sum of all the scores, truncated by 10:

$$\text{Mark} = \min(\text{ECA1} + \text{ECA2} + \text{ECA3} + \text{Bonus} + \text{PG}, 10)$$

2. Extraordinary exam.

Students who did not pass the course at the end of the semester can take an extraordinary final exam that will cover all the contents of the subject, both theoretical and practical, and that may include multiple choice tests, reasoning questions, problem solving and / or exercises, as well as the development of practical cases. The score achieved in it (between 0 and 10) will be the final grade.

Students whos have followed the continuous assessment may decide, on the same day of the exam, whether or not to keep their continuous assessment grade in the same way as in the first opportunity final exam.

End-of-program exam:

There will be an exam that will cover all the contents of the subject, both theoretical and practical, and that may include multiple choice tests, reasoning questions, problem solving and / or exercises, as well as the development of practical cases. The score achieved in it (between 0 and 10) will be the final grade.

Additional comments:

- Students must attend the practices in the group assigned to them at the beginning of the semester.
- All marks in the evaluation are individual.
- Taking the ECA2 or successive scoring tests and / or any of the final exams will mean that the student will have a different grade than "Not presented".
- The grade obtained in continuous evaluation will be valid only for the academic year in which it is carried out.
- The subject is considered approved if the final grade is equal to or greater than 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.

Plagiarism.

Plagiarism is regarded as serious dishonest behaviour. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

Use of Generative Artificial Intelligence

In carrying out the academic activities of this subject, the use of generative artificial intelligence (GAI) is allowed. Its use must be carried out in an ethical, critical and responsible manner. In the case of using IAG, any results it provides should be critically evaluated, and any citations or references generated should be carefully verified. It is also recommended to declare the use of the tools used.

Sources of information

Basic Bibliography

James W. Nilsson, **Electric Circuits**, 10, PEARSON, 2014

Material docente, **Página web**, moovi.uvigo.gal,

Complementary Bibliography

J.H. McClellan, R.W. Schafer, M.A. Yoder, **Signal Processing First**, PEARSON, 2003

Recommendations

Subjects that continue the syllabus

Physics: Fundamentals of electronics/V05G301V01201
Digital Signal Processing/V05G301V01205
Signal Transmission and Reception Techniques/V05G301V01208

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 2/V05G301V01106

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101

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.