Universidad de Alcalá

TEACHING GUIDE

Circuit Analysis

Degree in
Computer Engineering (GIC)

Universidad de Alcalá

Academic Year 2021/2022

2nd Year - 2nd Semester (GIC)

Approved by the School Board on July 6, 2021

TEACHING GUIDE

Course Name:	**Circuit Analysis**
Code:	**590003 (GIC)**
Degree in:	**Computer Engineering (GIC)**
Department and area:	**Teoría de la Señal y Comunicaciones** **Signal Theory and Communications**
Type:	**Compulsory (GIC)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year - 2nd Semester (GIC)**
Teachers:	To be defined.
Tutoring schedule:	To be confirmed at the beginning of the course.
Language:	English

1. COURSE SUMMARY

The current society demands the use of new Information and Communications Technologies (ICT). These technologies involve a series of electronic equipment and devices such as mobile phones, satellites or antennas. The design, optimization and maintenance of these equipment's requires the knowledge of electrical systems and circuit analysis.

Requirements and recommendations:

In the course of Circuit Analysis complex mathematical concepts will be used. It is recommended that the students have some ability in solving mathematical problems, and, more specifically, using complex numbers and trigonometry, solving systems of linear equations, decomposition in simple fractions and using exponential functions.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following basic, generic and cross curricular skills:

en_CG8 - Knowledge of the basic subjects and technologies, which enable them to learn and develop new methods and technologies, as well as those that provide them with great versatility to adapt to new situations.

en_CG9 - Ability to solve problems with initiative, decision making, autonomy and creativity. Ability to know how to communicate and transmit the knowledge, skills and abilities of the profession of Computer Engineering Engineer.

en_CB1 - That students have demonstrated to possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

en_CB2 - That the students know how to apply their knowledge to their work or vocation in a professional manner and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

en_CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

en_CB4 - That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized public.

en_CB5 - That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Specific Skills

This course contributes to acquire the following specific skills:

en_CIC1 - Ability to design and build digital systems, including computers, microprocessor-based systems and communications systems.

en_CIC5 - Ability to analyze, evaluate and select the most suitable hardware and software platforms for the support of embedded and real-time applications.

Learning Outcomes

After succeeding in this subject the students will be able to:

RA1. Identify the key elements used to build electrical circuits, including their functionality and symbology.

RA2. Recognize the physical phenomena that occur in linear electrical circuits, particularly in sinusoidal steady state.

RA3. Apply the fundamental theorems of circuit theory to the analysis of any linear circuit in sinusoidal steady state.

RA4. Assemble prototypes of electric circuits and use the basic equipment's of any electrical circuit laboratory.

3. CONTENTS

Contents Blocks	Total ECTS
Module 1. Basic concepts. Circuits fundamental laws. Working functions of the passive elements. Exercises.	0.9
Module 2. Sinusoidal Steady State circuit analysis. Exercises.	0.8
Module 3. Circuit's power supply (Generators). Exercises. Systematic circuit analysis. Exercises.	0.8
Module 4. Fundamental theorems. Exercises.	0.6
Module 5. Two-port Networks. Exercises.	0.4
Lab practices. Passive components, power source, function generator, multimeter and oscilloscope. Exercises.	2.5

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (56 hours on-site +2 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

The teaching strategy of the course is divided into 3 sections: classroom learning, learning in small groups and finally the working sessions in the laboratory.

Sessions of large group in the classroom:

Working sessions in the classroom, in large groups, will consist of lectures where the main concepts of the theory of circuits will be presented.
The aim is to introduce students to the theoretical foundations of circuit analysis in a guided and reflective way. The understanding of these concepts will be enhanced in the small learning group with a more individualized assistance, by promoting both autonomous and grouped resolution of practical exercises and, also, with real experimentation in the lab. Teaching materials will be essential to create reflective learning environments, where students and teachers can undertake a critical analysis that allows the student to autonomously relate concepts.

The order of presentation of the contents will evolve from the simple to the complex, in order to avoid a high degree of abstraction that might cause a student lack of interest in the course. In any case, it is very convenient, during the working sessions in the classroom, to establish linkages with other subjects in the curriculum, and to provide possible experience on the contents, which will help to attract students' attention and will encourage their interest in the subject.

Sessions of small groups:

In the small groups of problems, our aim is to create participatory working environments. The students will solve theoretical problems with their peers, putting into practice the concepts covered during training sessions in the classroom. Student participation is essential, so we will use strategies to promote it (e.g. rounds of questions, debates, etc.). Our aim is to complete the teaching-learning process of the student, bringing he to the assimilation of concepts and their applications. We will emphasize that the analytical techniques must be considered as tools, not as goals. The strategies to adopt in these sessions are intended to promote the student habits when faced with solving a problem, namely: initial study of the circuit, choosing the best strategy for solving and critical evaluation of the results.

Information and Communications Technologies can also be used for supporting some of the training activities (Internet, forums, wikis and email, available materials in e-learning platforms, etc.).

Laboratory sessions:

Laboratory sessions comprise the third and final learning stage. The working sessions will be conducted

in small groups, in which the student must work with her peers. The goal is that the student explores, with the help of a practical manual designed for the course, the applicability of the concepts of circuit theory. To this end, the methodology will be as follows.

Before each laboratory session, the student must practice in virtual format, it will use the software that is considered most appropriate and which can be downloaded for free from the corresponding website. The virtual practice will serve as support for the realization of the practice in the laboratory.

In the laboratory, students will perform the corresponding practice in groups of 2 or 3 people and at the end they will take a quiz that includes the contents of the practice.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Ordinary Call

Continous Assessment:

Given the importance of this course in most of the subjects of subsequent courses in the degree of electrical engineering, the assessment should not only ensure that the student has obtained the main concepts of circuit theory, but that he has reached sufficient skills to be able to extrapolate that knowledge to the problems that students will find in the subjects mentioned.

Thus, it will be necessary to emphasize the educational nature of the continuous assessment described here. Since the main skills pursued by this course are related to the ability to analyze and solve problems by applying the theoretical concepts studied, the assessment will use instruments based on objective test of different types: problem solving and written tests focused on theoretic arguments.

According to this line, the main assessment tools will be:

1. Laboratory quizzes (TLx). Performance of 3 laboratory practices and answer to their quizzes. The evaluation will consider the systematic observation, where the teacher will record the main difficulties and skills observed in each student, and the completion of a quiz for each practice.
2. Laboratory exam (PL). It consists of the assembly of an electrical circuit and the realization of different measurements in this circuit.
3. Evaluation Exams (PEx) Performance of 2 written exams focused on both practical and theoretical aspects of the subject. Consisting in the resolution of problems of application of the contents of the course.

Students must attend 100% of the laboratory sessions and deliver the corresponding reports to all laboratory practices. Recovery sessions will be enabled for those students who have not attended any of the sessions and justify it documentarily.

Assessment through final exam:

In the case of evaluation by means of a final exam, the evaluation elements to be used will be the following:

1. Laboratory Quiz (TL). Quiz with contents of the laboratory practices.
2. Laboratory exam (PL). It consists of the assembly of an electrical circuit and realization of different measurements in this circuit.
3. Final exam (FEF). Similar to the evaluation exams carried out during the continuous assessment.

Extraordinary Call

The procedure will be the same as that described for the assessment by means of a final exam in the ordinary call.

5.2. EVALUATION

EVALUATION CRITERIA

The assessment criteria measure the level in which the competences have been acquired by the student. For that purpose, the following are defined::

CE1. The student is able to analyze and understand the operation of any linear circuit, regardless of the nature and complexity of it.

CE2. The student understands and is able to handle the equipment of a laboratory electrical measurement.

CE3. The student acquires skills to search for information and to coordinate with other partners to solve the proposed activities in small group sessions, in the laboratory, or when working outside the classroom.

CE4. The student is able to express the resolution of a problem in a clear way, orderly, and always following the correct nomenclature and formulation.

GRADING TOOLS

This section describes the grading tools that will be applied to each of the evaluation criteria.

- **Laboratory Quizzes (TLx):** 3 quizzes referring to the results and conclusions of the 3 laboratory practices (one quiz per practice).

- **Laboratory Exam (PL):** It consists of the assembly of an electrical circuit and the realization of different measurements in this circuit.

- **Evaluation Exams (PE1 y PE2):** Written exams focused on the practical and theoretical aspects of the subject. Consisting in the solving of exercises of application of the contents of the course. There will be 2 of these exams that will coincide with blocks 1 and 2 for the first one and the remaining blocks of the contents for the second one.

- **Final Evaluation Exam (PEF):** A single exam with the same characteristics as the PEx, but only those students who opt for the final evaluation will have to take it.

GRADING CRITERIA

In the ordinary call-continuous assessment the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows:

Skill	Learning Outcomes	Evaluation Criteria	Grading tool	Contribution to the final mark
CG8, CG9	RA1, RA2	CE1, CE4	PE1	40%
CG8, CG9	RA2, RA3	CE1, CE4	PE2	40%
CG9, CIC1	RA1, RA4	CE2	PL	12%
CIC1	RA1, RA2	CE3	TL	8%

The grade of "Not presented" will be given to the student who, having taken the continuous assessment procedure, is in default of any of the following conditions:

- When the student has not attended at least 60% of the on-site laboratory sessions.
- When the student has not taken at least 60% of the exams (TL, PL, PE1 and PE2).

In the ordinary call-final evaluation, the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows:

Skill	Learning Outcomes	Evaluation Criteria	Grading tool	Contribution to the final mark
CG9, CIC1	RA1, RA2, RA4	CE2, CE3	PL, TL	20%
CG8, CG9	RA2, RA3	CE1, CE4	PEF	80%

Extraordinary call

In the case of the extraordinary call, the same percentages that have been established in the case of the evaluation by final exam will be applied.

It is a requirement to pass the course in any of the calls to pass:

- The skills corresponding to the laboratory (which means getting 1 point out of 2 possible), through the laboratory practices (PL) together with the laboratory quiz (TL).
- The skills related to module 3, 4 and 5, which will be evaluated in PE2, which implies a minimum score of 1 point out of a possible 4.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Desoer C.A. and Kuh, E.S., Basic Circuit Theory, McGraw-Hill, 1966.

6.2. Additional Bibliography

- Van Valkenburg, M. E., Network Analysis - 3rd Edition. Prentice-Hall, 1974.
- Balabanian, N., Fundamentals of circuit theory, Allyn & Bacon, 1961.

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.