

Course guide

330221 - TCI - Circuit Theory

Last modified: 04/05/2023

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: M. ROSA GIRALT MAS

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. An understanding and mastery of the foundations of linear systems and the associated transforms and functions, electrical circuits theory, electronic circuits, the physical principle of semiconductors and logic families, electronic and photonic devices, and their use in solving engineering problems.

Transversal:

2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

The course consists of face-to-face activities consisting of 3 hours per week in class (large group) and 2 hours per fortnight in the laboratory (small group).

The student carries out learning through various mechanisms. In the lectures and participative classes, the contents of the subject are presented and the interaction between students and teacher is facilitated. Individual / group personal work activities are also proposed to contribute to the understanding of the subject.

In laboratory classes, students carry out preliminary work that helps to put into context the work that is intended to be carried out in the laboratory. The laboratory activity itself is developed in groups of two students and allows experimentation with certain developed aspects of the subject. The writing of the memory and the interaction with the teacher in the laboratory allows working on the oral and written communication skills.

From time to time, nomenclature is introduced in English to progressively start the student in learning this language.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the Circuit Theory course, the student:

- You will understand and know how to use the basic concepts of analysis and design of resistive linear circuits with operational and first order amplifiers.
- You will be able to apply experimental techniques and learn the manipulation of basic laboratory equipment and instruments.
- Increase your ability to communicate orally and in writing.
- You will increase your capacity for planning, organization and learning both personally and as a team.
- Will have developed reasoning techniques and strategies for analysis and problem solving.
- They will have enhanced their critical vision and their capacity for autonomous learning.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours large group	45,0	30.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1. FOUNDATIONS OF CIRCUIT THEORY

Description:

1. Circuit variables
2. Modeling and analysis
3. Circuit elements and constitutive equations
4. Interconnection laws

Related activities:

A1, A2, A3, A4 and A5

Full-or-part-time: 24h

Theory classes: 8h

Laboratory classes: 2h

Self study : 14h

2. ELEMENTARY CIRCUIT ANALYSIS

Description:

1. Series and parallel connection. Equivalent bipoles
2. Transformation of sources. Equivalent bipoles
3. Voltage and current dividers
4. Linear circuit theorems
5. Elemental analysis of linear circuits
6. Thevenin and Norton equivalents
7. Power transfer

Related activities:

A1, A2, A3, A4 and A5

Full-or-part-time: 24h

Theory classes: 8h

Laboratory classes: 2h

Self study : 14h

3. CIRCUITS WITH OPERATIONAL AMPLIFIERS

Description:

1. Controlled sources
2. The operational amplifier (AO)
3. AO applications in non-linear zone
4. Applications of the AO in linear zone
5. Linearity test
6. Basic circuits with AO

Related activities:

A1, A2, A3, A4 and A5

Full-or-part-time: 65h

Theory classes: 16h

Laboratory classes: 9h

Self study : 40h

4. SYSTEMATIC METHODS OF ANALYSIS

Description:

1. Method of nodal stresses. Nodal analysis
2. Mesh current method

Related activities:

A1, A2, A4 and A5

Full-or-part-time: 16h

Theory classes: 6h

Self study : 10h

5. ANÀLISI DE CIRCUITS DE PRIMER ORDRE

Description:

1. Elements dinàmics
2. Circuits de primer ordre amb AO
3. Funcions bàsiques d'excitació i resposta
4. Circuits de primer ordre amb excitacions constants

Related activities:

A1, A2, A3, A4 and A5

Full-or-part-time: 21h

Theory classes: 7h

Laboratory classes: 2h

Self study : 12h

ACTIVITIES

1. EXPOSURE AND PROBLEM CLASS

Description:

They are face-to-face classes dedicated to understanding the contents of the subject, carrying out exercises and proposing new exercises that justify the presentation of new contents.

Specific objectives:

Upon completion of the Circuit Theory course, the student:

- You will understand and know how to use the basic concepts of analysis and design of resistive linear circuits with operational and first order amplifiers.
- Will have developed reasoning techniques and strategies for analysis and problem solving.

Material:

Recommended bibliography

Published teaching material

Full-or-part-time: 40h

Theory classes: 40h

2. STUDY OF CONTENTS

Description:

The study of the contents is the individual and / or collective activity that leads to understanding and assuming the knowledge, vocabulary and techniques that are part of the contents of the subject.

Specific objectives:

Upon completion of the Circuit Theory course, the student:

- You will understand and know how to use the basic concepts of analysis and design of resistive linear circuits with operational and first order amplifiers.
- You will increase your capacity for planning, organization and learning both personally and as a team.
- Will have developed reasoning techniques and strategies for analysis and problem solving.
- They will have enhanced their critical vision and their capacity for autonomous learning.

Material:

Recommended bibliography

Published teaching material

Full-or-part-time: 30h

Self study: 30h

3. LABORATORY CLASS

Description:

The activity will take place in the laboratories of the degree. It consists of carrying out a preliminary study. In the laboratory the results of this previous study are contrasted with the experimental results of the assembly carried out.

Throughout the laboratory session, it is necessary to explain the discrepancies between the theoretical and experimental results, propose solutions and, if necessary, redesign or propose new experiments.

Specific objectives:

Upon completion of the Circuit Theory course, the student:

- You will be able to apply experimental techniques and learn the manipulation of basic laboratory equipment and instruments.
- Increase your ability to communicate orally and in writing.
- You will increase your capacity for planning, organization and learning both personally and as a team.

Material:

Practice Manual
Laboratory equipment
Recommended bibliography
Published teaching material

Delivery:

A preliminary study is delivered before entering the laboratory and a report at the end of the session. Both constitute the laboratory evaluation that accounts for 30% of the final evaluation.

Full-or-part-time: 45h

Laboratory classes: 15h

Self study: 30h

4. PERFORMANCE OF EXERCISES

Description:

Exercises that the students have to solve individually or in teams and that they have to defend individually in front of the teacher of the subject in an oral interview lasting 10'-15 '.

Specific objectives:

Upon completion of the Circuit Theory course, the student:

- You will understand and know how to use the basic concepts of analysis and design of resistive linear circuits with operational and first order amplifiers.
- Increase your ability to communicate orally and in writing.
- Will have developed reasoning techniques and strategies for analysis and problem solving.

Material:

Recommended bibliography
Published teaching material

Delivery:

A folder with the solved exercises that together with the oral defense of the folder contribute 20% of the final evaluation.

Full-or-part-time: 20h

Self study: 20h

5. EXAM

Description:

Written activity in which the knowledge acquired up to the moment of the test is evaluated. During the course there will be an individual control test (A5P). At the end of the course, a final globalizing test of the acquired knowledge will be carried out (A5F).

Specific objectives:

Upon completion of the Circuit Theory course, the student:

They will have synthesized and consolidated the concepts and techniques worked so far.

Material:

Test statements

The collection of the entire course

Delivery:

Exercises of the tests, which contribute 50% of the final evaluation.

Full-or-part-time: 15h

Theory classes: 5h

Self study: 10h

GRADING SYSTEM

The final grade for the course will be obtained as follows:

25% Laboratory activities (A3)

15% Completion of exercises (A4)

20% Partial Exam (A5P)

40% Final Exam (A5F)

The evaluation will be continuous.

Note 1. The qualification in a part or in the whole of the final test will replace, if it is higher and there is a coincidence in the evaluated aspects, the results obtained in other evaluation records carried out throughout the course.

Note 2. When the results of the evaluation reports corresponding to individual activities are substantially lower than those obtained in group activities, the individual execution of activities similar to those carried out in a group may be required. The qualification of the last ones will replace the original ones.

EXAMINATION RULES.

All activities are compulsory.

If any of the activities of the subject is not carried out, it will be considered a zero.

Carrying out the laboratory activities is a necessary condition to pass the subject.

In the case of laboratory activities for which a previous study has been established, it will be mandatory to submit it before accessing the laboratory.

Those activities that are explicitly declared as individual, whether in person or not, will be carried out without any collaboration from other people.

The dates, formats and other delivery conditions established will be mandatory.

BIBLIOGRAPHY

Basic:

- Thomas, Roland E.; Rosa, Albert J. Circuitos y señales: introducción a los circuitos lineales y de acoplamiento. Barcelona: Reverté, 2002. ISBN 8429134581.

Complementary:

- Thomas, Roland E.; Rosa, Albert J. The analysis and design of linear circuits. 6th ed. Hoboken: John Wiley & Sons, 2009. ISBN 9780470383308.



- Irwin, J. David. Análisis básico de circuitos en ingeniería. 6ª ed. México: Limusa Wesley, 2003. ISBN 9681862953.

RESOURCES

Other resources:

- Circuit Theory Practice Manual.
- Collection of Circuit Theory problems.