
DEGREE CURRICULUM

# CIRCUIT THEORY

Coordination: CLARIA SANCHO, FRANCISCO

Academic year 2021-22

# CIRCUIT THEORY 2021-22

## Subject's general information

<table>
<tr><td>Subject name</td><td>CIRCUIT THEORY</td></tr>
<tr><td>Code</td><td>102128</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Not informed</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
</table>
</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>0.6</td><td>2.4</td><td>3</td></tr>
<tr><th>Number of groups</th><td>2</td><td>1</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Coordination</td><td>CLARIA SANCHO, FRANCISCO</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>(40% ) 60 h classroom or online<br>(60%) 90 h independent work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Castellano</td></tr>
</table>

# CIRCUIT THEORY 2021-22

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|---|---|---|---|
| CLARIA SANCHO, FRANCISCO | francisco.claria@udl.cat | 5,4 | |
| MONTALBAN BAU, GESSAMI | gessami.montalban@udl.cat | 1,2 | |

## Subject's extra information

It is a subject that is offered in the second year, is framed in the field of electrical engineering and belongs to specific technology module. The content of this course provides the basis to contextualize the subjects for electronic and automatic control

This subject aims to familiarize students with the transformation of circuits and systems to the Laplace domain. We study the temporal response of circuits using the Laplace transform, is given notion of transfer function and introduces the concepts of natural and forced response. We also study the frequency response of circuits, and emphasize the concepts of resonance, spectrum, stability and filtering. With these basics, it becomes apparent association of transfer function and system, marking the way for the analysis and design of electronic systems and control.
The analysis of circuits and transformed systems is often , in general, new to the student. For this reason the content of this field requires some time to be assimilated. The daily study is the best guarantee that the concepts are consolidated throughout the course.

You can have specific educational material for the subject in  Virtual Campus.

PRACTICES AT EPS

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed  below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this

reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

**GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES**

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

# Learning objectives

Objectives

- Analyze a circuit using differential equations.
- Know and use the Laplace Transform (LT) to transform circuits and systems.
- Calculate the time response from transformed circuits or systems.
- Understand the concept and get the transfer function of circuits and systems.
- Knowing the meaning of amplitude and phase spectrum of a transfer function.
- Fix the concept of resonance and its spectral and temporary meaning.

# Competences

**Cross-disciplinary competences** approved by the Comissió Plenària dels Graus d'Enginyeria Industrial, Enginyeria Informàtica i Enginyeria de l'Edificació, gathered 16 Juny 2008.

- **EPS1**. Ability to solve problems and develop and defend arguments within their field of study
- **EPS6.** Capacity for analysis and synthesis

**Specific competences** that students should acquire, according ORDRE CIN/351/2009, 9 of febrer.

- **GEEIA19.** Applied knowledge of electrical engineering.

# Subject contents

**CHAPTER 1**

**1.RESISTIVE CIRCUITS. ELEMENTS AND TOOLS**

1.1 INTRODUCTION

8.3 REAL TRANSFORMER

8.4 MAXIMUM TRANSFER OF POWER THEOREM

8.5 EXERCISE OF APPLICATION

8.6 PROPOSED PROBLEMS

**CHAPTER 9**

**9. TWO-PORT NETWORKS**
9.1. INTRODUCTION
9.2. PARAMETERS ADMITTANCE
9.3. PARAMETERS IMPEDANCE
9.4. PARAMETERS HYBRID
9.5. PARAMETERS OF TRANSMISSION
9.6. CONVERSION OF PARAMETERS
9.7. INTERCONNECTION OF QUADRIPOLES

## Methodology

**Master class:** In the master classes the contents of the subject are presented orally by a professor without the active participation of students.

**Problem-based learning:** Problem-based learning is used as a method of promoting the learning from selected problems of real life.

**Classroom practices:** Let you apply and configure a practical level, the theory of a field of knowledge in a particular context.

## Development plan

| Week | Metodologi | Agenda | Classroom | Autonomous work |
|---|---|---|---|---|
| 1-2 | Master class<br>Problem-based learning | RESISTIVE CIRCUITS. ELEMENTS AND TOOLS | 6 | 12 |
| 3-5 | Master class<br>Problem-based learning | CIRCUITS WITH RESISTORS INDUCTORS AND CAPACITORS<br>SIGNALS AND THEIR CHARACTERISTICS | 12 | 18 |
| 6 | Master class<br>Problem-based learning | CIRCUITS ANALYSIS IN THE LAPLACE DOMAIN | 8 | 6 |
| 7-8 | Master class<br>Problem-based learning | RESPONSE IN TIMEOF LINEAR CIRCUITS | 10 | 12 |
| 9-11 | Master class<br>Problem-based learning | FREQUENCY RESPONSE OF LINEAR CIRCUITS | 12 | 18 |

| | | | | |
|---|---|---|---|---|
| 12-14 | Master class<br>Problem-based learning | PERMANENT SINUSOIDAL REGIME<br>TRANSFORMER<br>TWO-PORT NETWORKS | 12 | 18 |

## Evaluation

Evaluation Method

During the semester, there shall be four assessments in the form of two written tests and two papers that account for the study and the work done in the labs. These documents will have a maximum score of 1 point each and not considered any improvement threshold. The two written tests will be held on dates determined by the EPS for this purpose.

In this course, by its nature, has little sense to evaluate parts of avoiding your stuff previous contents. Thus, each written test will be on all the stuff that has been given so far.

The first written test will have a maximum score of 3 points and be considered approved if the score is greater than or equal to 1.5 points. The second written test will have a maximum score of 5 points and will be considered approved if the score is greater than or equal to 2.5 points.

As the material is cumulative in each written test, if the second test is passed, then the first test will be compensated if the latter has not been surpassed, with half its maximum score (1.5 points).

-The total score is the sum of the notes of the 4 reviews. (This is the first of the two possible pathways of qualifications that are contemplated).

-If the second written test you get a lower score to 2.5 points, you must use the recovery activity, to be performed on the date set by the EPS. The written test will have a valuation recovery maximum 8 points and be deemed to have been passed if you get a note added to the laboratory practice notes and document preparation practices study is greater than or equal to 5 points. (This is the second pathway)

In addition:

Any person enrolled in this course, which has been submitted to the second written test, whether it was surpassed or not, there may be a recovery test to increase the final grade. If the second test was successful the final qualification will never be lower than it would have obtained for the first approach.

## Bibliography

**Bibliography and resources**

**Basic Bibliography:**

**Análisis de circuitos**

F. Clariá, J.A. Garriga, J. Palacín

Ed. Edicion de la Universitat de Lleida, 1999

**Donald E. Scott.**

*Introducción al análisis de circuitos, un enfoque sistemático.*

Ed. Mc. Graw-Hill. 1988.

**William H. Hayat Jr., Jack E. Kemmerly.**

*Análisis de circuitos en ingeniería.*

Ed. Mc. Graw-Hill. 1988.

**A. Bruce Carlson.**

*Circuitos.*

Ed. Tomson. 2001

**Extended Bibliography:**

**Josep A. Edminister, Mahmood Nahvi.**

Schaum. *Circuitos Eléctricos.*

Ed. Mc. Graw-Hill. 1997

**J. D. Irwing.**

*Análisis básico de circuitos en ingeniería.*

Ed. Prentice Hall. 1997

**R. Sanjurjo Navarro, E. Lázaro Sanchez, P.de Miguel Rodríguez.**

Teoría de *circuitos eléctricos.*

Ed. Mc. Graw-Hill. 1997

**James W. Nilsson.**

*Circuitos Eléctricos.*

Ed. Addison Wesley Iberoamericana. 1995

**A. Gómez Expósito, J.A. Olivera Ortiz de Urbina.**

*Problemas resueltos de Teoría de Circuitos.*

Ed. Paraninfo. 1990

**J.M. Miró, A. Puerta, J.M. Miguel, M. Sanz.**

*Análisis y diseño de circuitos con PC.*

Ed. Marcombo. 1989

**Murray R. Spiegel.**

*Transformadas de Laplace.*

Ed. Mc. Graw-Hill. 1985

**M. Torres.**

*Circuitos integrados lineales.*

Ed. Paraninfo. 1985

**Gladwyn Lago, Lloyd M. Benningfield.**

*Teoría de sistemas y circuitos.*

Ed. Limusa. 1984

**J. Herrera.**

*Teoría de Circuitos.*

Ed. Limusa. 1980

**F. Jimenez.**

*Análisis de Circuitos Eléctricos. Teoría y Problemas.*

Ed. Limusa. 1980

**M.E. Van Walkenburg.**

*Análisis de Redes.*

Ed. Limusa. 1977

**Hugh Hildreth Skilling.**

*Circuitos en ingeniería eléctrica.*

*Ed. Compañía editorial continental S.A. 1974*