Course guide
220099 - TC - Circuit Theory

Last modified: 25/07/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Ramon Mujal Rosas

Others: Borja García Marco
Gloria Sola De Las Fuentes

PRIOR SKILLS

It is advisable to have taken and passed the subjects Physics I amb Physics Extension
Basic notions of electricity, such as understanding the concepts of intensity, tension, resistance, power or energy.
Know how to identify and understand how the most important electrical parameters work, such as resistance, coils and capacitors.
Know electrical calculation methods. at least one initial idea, from Kirchhoff, Mallas or Knots
Know the most important electrical theorems. Or at least an initial idea from Thevenin, Norton, Maximum Power, Superposition, etc.
Notions about alternating current. Vectors, operations with complex numbers, alternating font types.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE10-INDUS. Knowledge and use of principles of circuit theory and electric machines. (Common module for industrial engineering)

TEACHING METHODOLOGY

The teaching methodology will consist of:
In-person sessions to present theoretical content in large groups.
In-person problem-solving sessions in medium groups
In-person sessions for carrying out laboratory practices and simulation in small groups.
Autonomous work of study and completion of exercises and problems.
To carry out the methodology, the student will have the support teaching material that will be posted on ATENEA.
The teaching guide and the subject programming will also be posted on ATENEA, with the distribution of the theory and problem groups, as well as the practical subgroups, ways of evaluating, class schedules and student attention, theory topics, problems, recommendations for the study of the subject.
The practices will be divided into laboratory practices and computer simulation practices.
To carry out autonomous work, a weekly dedication schedule will be made.

LEARNING OBJECTIVES OF THE SUBJECT

The subject of Circuit Theory is the basis with which we will later enter into the study of other subjects such as electrotechnics, electrical machines, line design, or electronics and the regulation and control of machines.
It is therefore a basic subject, since it will first unify the students' previous knowledge, which is very different depending on their origin, to subsequently advance and provide the necessary work tools to be able to undertake any subject later. electrical theme with guarantees of success.
Finally, in the last part of the course, practical examples of application of the knowledge obtained in the study of the subject will be given, which should allow the student to see the usefulness of what has been learned, and, in addition, see a subject that a priori, with so much theoretical knowledge they may seem unconnected, to take shape and understand their interconnection towards the end of the subject.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	14,0	9.33
Self study	90,0	60.00
Hours small group	14,0	9.33
Hours large group	32,0	21.33

Total learning time: 150 h

CONTENTS

Unit I: Analysis of DC circuits

Description:
Introduction, electrical parameters in direct current (DC), electrical circuits in DC, power in DC, measurements in DC, independent and dependent sources of voltage and intensity in DC.

Specific objectives:
Know the general aspects of alternating current.

Related activities:
classroom theory in large groups.
Problems and exercises in the classroom in medium-sized direct current groups.
Laboratory practices, problems, classroom exercises.
First evaluation exam.

Full-or-part-time: 24h
Theory classes: 5h
Practical classes: 2h
Laboratory classes: 2h
Self study : 15h

Unit II: Analysis of AC circuits

Description:

Introduction, electrical parameters in alternating current (AC), electrical circuits in AC, power in AC, power factor, power factor improvement, measurements in AC, resonance, independent and dependent sources of voltage and intensity in AC.

Specific objectives:
Know the general aspects of alternating current.

Related activities:
Theory in classroom with large groups
Problems and exercises in the classroom with medium groups of alternating current.
Laboratory practices, problems, classroom exercises.
First evaluation exam

Full-or-part-time: 24h
Theory classes: 5h
Practical classes: 2h
Laboratory classes: 2h
Self study : 15h

Unit III: Network Theorems electric

Description:
Kirchhoff's laws, mesh method, knots and source translation.
Thevenin's, Norton's, substitution's, Millman's and maximum power transfer theorems.

Specific objectives:
Know and correctly apply the theorems in direct and alternating current.

Related activities:
Theory in classroom with large groups
Problems and exercises in the classroom with medium groups of networks and electrical theorems
Laboratory practices, problems and exercises in the classroom.
First evaluation exam

Full-or-part-time: 24h
Theory classes: 5h
Practical classes: 2h
Laboratory classes: 2h
Self study : 15h

Unit IV: transistor circuits first and second order

Description:
Transient regime, differential equations of first and second order circuits, initial and permanent conditions, time constants, damping factor, different types of responses.

Specific objectives:
Correctly state the equations and responses of electrical circuits in a transient regime.

Related activities:

Theory in classroom with large groups
Problems and exercises in the classroom with medium groups of first and second order transients
Laboratory practices, problems, and classroom exercises.
Second evaluation exam

Full-or-part-time: 27h
Theory classes: 6h
Practical classes: 3h
Laboratory classes: 3h
Self study : 15h

Unit V: balanced and unbalanced three-phase systems

Description:

Balanced and unbalanced three-phase systems, generation of three-phase voltages and currents, line and phase voltages and currents, connection of loads, impedance transformation, active, reactive and apparent power in three-phase systems.

Specific objectives:
Understand and know how to correctly apply the basic concepts of balanced and unbalanced three-phase electrical systems.

Related activities:

Theory in classroom with large groups
Problems and exercises in the classroom with medium groups of balanced and unbalanced three-phase systems
Laboratory practices, problems and exercises in the classroom.
Second evaluation exam

Full-or-part-time: 27h
Theory classes: 6h
Practical classes: 3h
Laboratory classes: 3h
Self study : 15h

Unit VI: Practical applications of circuit theory

Description:
Examples of quadrupoles, electrical machines, low voltage systems, power lines, reactive energy compensation.

Specific objectives:
Apply and see the usefulness of the knowledge learned throughout the subject in real cases of electrical systems.

Related activities:

Theory in classroom with large groups
Problems and exercises in the classroom with medium groups of real electrical systems
Laboratory practices, problems and exercises in the classroom.
Second evaluation exam

Full-or-part-time: 24h
Theory classes: 5h
Practical classes: 2h
Laboratory classes: 2h
Self study : 15h

ACTIVITIES

THEORY LESSONS

Description:
Presentation by the teacher of the theory topics: 1, 2, 3, 4, 5 and 6, in 2-hour weekly sessions in large groups.

Specific objectives:
Transmit concepts and physical interpretation of the theory sessions.

Material:
Notes and videos in ATENEA.
Bibliography of the subject.
own books

Delivery:
No deliveries necessary

Full-or-part-time: 38h
Self study: 14h
Theory classes: 24h

PROBLEM LESSONS

Description:
Resolution of problems and exercises by the teacher in small groups.

Specific objectives:
Assimilate the concepts taught in the theory and preparation of the partial and final exams.

Material:
Collection of problems of bibliography. Subject Books.

Delivery:
No problems should be delivered

Full-or-part-time: 56h
Self study: 42h
Practical classes: 14h

LABORATORY PRACTICE

Description:
Practices to see physical reality and consolidate what has been explained in theory.

Specific objectives:
Consolidate the concepts acquired in theory and problems.

Material:
Collection of practices.

Delivery:
Delivery of the completed report of the practices within the deadline indicated by the teacher.

Full-or-part-time: 16h
Laboratory classes: 8h
Self study: 8h

COMPUTER SIMULATION SESSIONS

Description:
Resolution of exercises and problems by computer

Specific objectives:
Contrast theory with problems, practices and simulations.

Material:
Collection of simulation practices.

Delivery:
Delivery of the completed report within the deadline established by the teacher.

Full-or-part-time: 12h
Laboratory classes: 6h
Self study: 6h

MONITORING PROBLEMS SESSIONS

Description:
Test o problemes

Specific objectives:
Consolidate knowledge and empower them to solve problems themselves.

Material:
Questions or problems posted on the ATENEA platform.

Delivery:
You will be notified of the date of completion of this activity with an approximate duration of 2 hours, or of the delivery of the required continuous evaluation problems.
This activity will not have weight in the grades of the subject, so its completion by the student will be voluntary.

Full-or-part-time: 6h
Self study: 4h
Theory classes: 2h

FRIST PARTIAL EXAM

Description:
Individual exam in the classroom, which consists of problems or tests corresponding to modules 1, 2, 3.

Specific objectives:
The test must demonstrate that the student has achieved the basic concepts corresponding to modules 1, 2 and 3.

Material:
Test statement, form and calculator.

Delivery:
3 hour test resolution.
It represents 40% of the final grade for the subject.

Full-or-part-time: 9h
Self study: 7h
Theory classes: 2h

FINAL EXAM

Description:
Individual exam in the classroom, which consists of problems or tests on the contents of modules 4, 5 and 6, and with added problems from modules 1, 2 and 3, which must be used to recover the first partial exam if you have one. suspended.

Specific objectives:
The test must demonstrate that the student has achieved the basic concepts related to modules 4, 5 and 6, and also that he remembers the knowledge acquired in modules 1, 2 and 3.

Material:
Test statement, Form and calculator.

Delivery:
Test resolution of about 3 hours.
It represents 45% of the final grade for the subject.

Full-or-part-time: 12h
Self study: 9h
Theory classes: 3h

RECOVERY EXAM FIRST PEMIAL SUBJECT

Description:
A 1-hour test will be carried out in which the student must demonstrate that he or she has reached the level required to recover this part of the subject (partial exam). To do this, a written test will be carried out that will be shorter than the exam that is recovered and with much more basic content.
This basic test will only allow you to pass the partial exam of the subject, that is, the maximum grade will be 5.
Only students who have not passed the partial exam for the subject, or who have not been able to take it, may take this test.

Specific objectives:
With this test the student is given the last opportunity to reach the minimum requirements to pass the subject, which would be more basic than in the normal exam, but the maximum grade will also be simply passed (5) or suspended. It is not possible to obtain more note by means of this test than it has been indicated is of minimum contained.

Material:
El material típic dun examen escrit. Material d'escriptura, calculadora i paper

Delivery:
The written test will be delivered on the same day and at the time of the test, corrected as soon as possible to have a reference note

Full-or-part-time: 1h
Theory classes: 1h

GRADING SYSTEM

THE FINAL GRADE FOR THE SUBJECT IS THE WEIGHTED SUM OF THE FOLLOWING PARTIAL GRADES:

PARTIAL EXAM NOTE
PRACTICAL NOTE
FINAL EXAM GRADE

FINAL GRADE = (0.40 x Midterm Exam Grade) + (0.15 x Practice Grade) + (0.45 x Final Exam Grade)

FIRST PARTIAL RECOVERY
All those students who cannot attend the partial exam activity or who have unsatisfactory results (less than 5), will be able to retrain the grade for this partial exam on the same day that the final exam is taken.

Therefore, in the final exam, there will be one or two additional theory problems or questions corresponding to the first part of the course (midterm exam).

With this redirection, the maximum grade that the student can achieve in the first part of the course (partial exam grade) is a pass (5), and this grade will be the highest of the grades obtained between the PARTIAL EXAM grade or the the FIRST PARTIAL RECOVERY, with the maximum mentioned of passing 5

EXAMINATION RULES.

Normally the exams, both problems and theory, will be without notes

When carrying out extra exercises, such as continuous evaluation exercises, notes or forms may be available, but in any case, their possible use will be indicated in each test.

To carry out the practices, any type of material will normally be available, except when a prior report is requested, in this case no type of material will be available.

In any case, before each test, it will be indicated in advance what materials will be available for its completion.

BIBLIOGRAPHY

Basic:
- Mujal, Ramón; Marín, Marc. Teoría circuitos: problemas [on line]. Barcelona: Iniciativa Digital Politècnica, 2016 [Consultation: 29/04/2024]. Available on: http://hdl.handle.net/2117/84321. ISBN 9788498805802.
- Mujal Rosas, Ramón. Calculo de líneas y redes eléctricas [on line]. Barcelona: Iniciativa Digital Politècnica, 2013 [Consultation: 29/04/2024]. Available on: http://hdl.handle.net/2099.3/36622. ISBN 9788476539866.
- Mujal, R.; Alabern, X. Comportamiento dinámico de sistemas: colección de problemas y prácticas. 2ª ed. Barcelona: Universitat Politècnica de Catalunya, 2000. ISBN 8484168522.
- Dorf, Richard C. Circuitos eléctricos: introducción al análisis y diseño. 3a ed. México: Alfaomega, 2000. ISBN 9701505174.
- Irwin, J. David. Análisis básico de circuitos en ingeniería. 6a ed. México: Limusa Wiley, 2003. ISBN 9681862953.

Complementary:
- Sánchez Barrios, Paulino. Teoría de circuitos: problemas y pruebas objetivas orientadas al aprendizaje. Madrid: Pearson Educación, 2007. ISBN 9788483223871.
- Fraile Mora, Jesús. Electromagnetismo y circuitos eléctricos. Madrid: E.T.S. Ingenieros de Caminos. Servicio de Publicaciones, Revista de Obras Públicas, 1990. ISBN 8474931312.

RESOURCES

Other resources:
Documentation posted in ATENEA about the subject, such as texts or videos