SUBJECT TEACHING GUIDE

G34 - Basic Experimental Physics IV: Circuits and Electronics

Double Degree in Physics and Mathematics

Double Degree in Physics and Mathematics

Degree in Physics

Degree in Physics

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Double Degree in Physics and Mathematics Degree in Physics Degree in Physics			Type and Year	Core. Year 1 Core. Year 1
Faculty	Faculty of Sciences				
Discipline	Subject Area: Basic Experimental Physics Basic Module				
Course unit title and code	G34 - Basic Experimental Physics IV: Circuits and Electronics				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Knowledge Field					
Web	https://moodle.unican.es/login/index.php				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	ALVARO GOMEZ GOMEZ
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Other lecturers	JUAN ANTONIO SAIZ IPIÑA OSCAR FERNANDEZ FERNANDEZ JOSE ANGEL MIER MAZA

4. OBJECTIVES
Know the basic laws of electrostatics, magnetostatics and the phenomenon of electromagnetic induction.
To introduce the student to the modeling of electrical and electronic devices from the concept of localized parameters and to know how to propose the correct approach depending on the needs of each practical situation.
Understand and perfectly handle the fundamental variables of circuit theory and its units.
Apply Kirchhoff's Laws to the resolution of direct current circuits.
Assimilate the concept of power and discern between absorption and dissipation of power by a circuit element.
Simplify linear circuits from their Thévenin or Norton equivalent as seen from two of its terminals.
Introduce the student in the handling of the most common techniques in circuit analysis.
Obtain the evolution in time of voltage and intensity in first-order RC and RL circuits, versus changes in power.
Know and learn to handle the basic instrumentation of measurement (voltmeter, ammeter, oscilloscope) and power of circuits (function generators, direct current power supplies) in electricity and electronics.

6. SUBJECT PROGRAM	
CONTENTS	
1	Thematic Block 1: Fundamentals of Electromagnetics
1.1	- Charge and Electric Force. Coulomb's Law. Electric Field of Charge Distributions. Electric Flux. Gauss' Law. Electric Potential. Capacity and Dielectrics. Stored energy in a Charged Capacitor. APPLICATIONS. - Electric Current and Current Density. Drift Speed. Resistance. Resistance and Temperature. Energy Electrical and Power. - Magnetic Field. Magnetic Field sources. Ampere's Law. Magnetic Flux. Electromagnetic Induction and Self-Induction. Faraday and Lenz Laws. Magnetic Field Energy associated with an inductor.
1.2	Resolution of problems and questions proposed by the teacher at the beginning of the development of the thematic block.
2	Thematic Block 2: Variables and Electric Circuits Components
2.1	- Electrical Circuits: Concepts and Types. Electrical Signals: Types. - Modeling of real components using ideal elements. Resistance. Sources. Capacitors. Inductances. - Fundamental Laws. Restrictions imposed by the Connections. Nodes, branches and Closed Loops.
2.2	Resolution of problems and questions proposed by the teacher at the beginning of the development of the thematic block.
3	Thematic Block 3: Circuit Analysis Techniques
3.1	- Thevenin and Norton Equivalents. Maximum transfered power. - Nodal Voltage and Mesh Current Analyses.
3.2	Resolution of problems and questions proposed by the teacher at the beginning of the development of the thematic block.
4	Thematic Block 4: Time Evolution of the circuit state
4.1	- Equations of the Elements that store Energy. Response Analysis of a Dynamic Circuit. Zero-input Response. Response to Zero State. Complete Response.
4.2	Resolution of problems and questions proposed by the teacher at the beginning of the development of the thematic block.
5	Thematic Block 5: Electronic Components
5.1	- Semiconductors. PN junction. Diodes: Types. Circuits with Diodes. Bipolar and FET Transistors. Operation. Characteristic curves. Direct Current and Switching behaviors. Circuits with Transistors.
5.2	Resolution of problems and questions proposed by the teacher at the beginning of the development of the thematic block.
6	GROUP WORK, ON PROBLEMS RELATING TO DIFFERENT THEMATIC BLOCKS (PA). Approach of problems to be solved by groups, to practice with the material presented in class. Grouping: groups of 2-4 students according to availability.
7	SIMULATION PRACTICES (PS). Introduction to Circuit Simulators (EWB). Grouping: individual.

8	BASIC ELECTRONIC PRACTICES (PEB). Grouping: by pairs or, if not, individual.
8.1	PRACTICAL WORK 1 - Study of Resistive Elements.
8.2	PRACTICAL WORK 2. Checking Thévenin and Norton equivalents.
8.3	PRACTICAL WORK 3 - Oscilloscope and Function Generator usage.
8.4	PRACTICAL WORK 4 - Study of the transient response of a series RC circuit.
8.5	PRACTICAL WORK 5 - Study of Diodes.
8.6	PRACTICAL WORK 6 - Study of Transistors.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Questions and / or problems relating to Theme blocks 1 and 2	Written exam	No	Yes	30,00
Questions and / or problems relating to Theme blocks 3, 4 and 5	Written exam	No	Yes	30,00
Group work, on problems relating to different thematic blocks	Work	No	No	10,00
Final Exam	Written exam	Yes	Yes	0,00
Laboratory Practices	Laboratory evaluation	No	Yes	30,00
Extraordinary Exam	Written exam	Yes	No	0,00
TOTAL				100,00

Observations

If for sanitary reasons:
(a) The minimum safety distance between students must be maintained, individual work should be made in the classroom and/or in the laboratories intended for this purpose. In addition, in this case, the number of practices to be performed will be reduced and the number of groups to do the PEB practices in the laboratory will be doubled.
(b) If In-person activity is suspended, practical sessions shall be conducted remotely, synchronously, at the usual time. Under these conditions, the number of PEB practices will be reduced and carried out from a series of experimental data that can be provided by teachers or, alternatively, obtained with the help of a circuit simulator. In this case, the remaining sessions not taught will be replaced by hours of tutoring and/or resolution of exercises by telematics.

- In order to pass the subject in continuous or regular evaluation, it will be necessary, on the one hand, (i) that the weighted average of the notes of the 2 written examinations (evaluations of Thematic Blocks 1-5) be equal to or greater than 5 and, on the other hand, (ii) that the weighted average of the notes corresponding to laboratory practices and the proposed work is equal to or greater than 5. Otherwise, the student must take the final exam and/or the extraordinary exam.
- In the final exam, the student may choose to improve the score of (i) the partial assessments he deems appropriate so that the weighted average of the written examinations is greater than or equal to 5 and/or (ii) to carry out a laboratory internship examination so that the weighted average of laboratory practices and the proposed work is equal to or greater than 5. In this case, the final grade of the subject will correspond to the grade obtained in the final exam.
- In the extraordinary assessment the student will be examined of the whole subject. Only the note of the practical part shall be saved if it is equal to or greater than 5. In this case, to pass the subject, the minimum grade required in each test (written tests and laboratory practice examination) is 5.
- If the number of laboratory sessions to be carried out during this course is less than or equal to that of the previous year, repeating students who have passed the practical part of the subject during the continuous evaluation period of the previous academic year will have the option of not having to carry out the practices again. To do this, they must talk to the teacher at the beginning of the course. On the other hand, if the number of practical sessions to be carried out in the current academic year is greater than that of the previous year, the repeating student who has approved the practices during the continuous evaluation period will have to carry out all the sessions corresponding to that batch of practices (classroom practices, simulation practices and / or basic electronics practices) regardless of whether any of the sessions had been carried out in the previous year.

* The exams will be done without notes or books.

Observations for part-time students

- The compulsory attendance and completion of all practices includes part-time students. As far as possible, and in accordance with the teacher, an attempt to facilitate the follow-up of the rest of the subject will be made.
- Part-time students must take the evaluation tests at the end of the semester and, if necessary, the extraordinary exam, which will constitute 60% of the Total Score. On the other hand, those students who cannot attend and perform laboratory practices throughout the course, must perform the exam corresponding to laboratory practices, which constitutes 30% of the Total Note. Additionally they will deliver throughout the course and in any case, before the final evaluation, individual works proposed by the professor whose evaluation will constitute 10% of the Total Note.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Tipler - Mosca, "Física para la Ciencia y la Tecnología", 6ª Edición, Vol.1 y 2 . Ed. Reverté, 2010.

Alexander - Sadiku, “Fundamentos de Circuitos Eléctricos”. 3ª Edición en español. McGraw-Hill, 2013.

P. Gómez Vilda, V. N. Nieto ... , "Fundamentos Físicos y Tecnológicos de la Informática". Pearson - Prentice Hall, 2007.