SUBJECT TEACHING GUIDE

G269 - PHYSICAL FUNDAMENTALS OF COMPUTING

Degree in Computer Systems Engineering

First Degree in Computer Systems Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Computer Systems Engineering First Degree in Computer Systems Engineering			Type and Year	Core. Year 1 Core. Year 1
Faculty	Faculty of Sciences				
Discipline	Subject Area: Physical Foundations of Computer Science Basic Training Module				
Course unit title and code	G269 - PHYSICAL FUNDAMENTALS OF COMPUTING				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Knowledge Field					
Web	https://moodle.unican.es/				
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

4. OBJECTIVES
Achieve the student knows the concepts of physics more directly related to the operation of computers and their peripherals, i.e., the basic principles of Electromagnetism, Optics and Quantum Physics explaining the operation of monitors, printers, magnetic and optical memories, and electronic circuits, among others.
Introduce students to the modeling of electrical and electronic devices from the concept of lumped parameters model. The main objective is to familiarize students in the management of the most common techniques in circuit analysis.
To provide practical knowledge on the use of basic measurement equipment (multimeter and oscilloscope) and power supply equipment (DC power supply and function generator) used in hardware laboratories.

6. SUBJECT PROGRAM	
CONTENTS	
1	Thematic Block 1: Electric field and electrical properties of matter
1.1	Electrical charge. Insulators and Conductors. Coulomb's Law. Electric field. Electric field of a charge distribution Electric field lines Electric flux Gauss's law. Apliccations. Electric potential. Obtaining the field from the potential. Electric potential due to continuous charge distributions. Apliccations. Capacitance and dielectrics. Calculation of capacitance. Combination of capacitors Energy stored in a charged capacitor. Capacitors with dielectrics Types of capacitors. Apliccations.
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: Electrokinetic
2.1	Electric current and current density. Drift speed. Resistance. Electrical energy and power Power in an electric heater Electrical circuit variables Electrical signals Direct current and alternating current Direct current circuits Thévenin and Norton equivalents. Maximum power transfer. Knots and Meshing techniques.
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: Magnetic field and electromagnetic induction. Maxwell equations
3.1	- Force exerted by a magnetic field. Force on current conductor. Motion of a charged particle. Lorentz Force. Apliccations. - Magnetic Field sources. Magnetic force between two parallel conductors. Ampere's law. Magnetic field of a solenoid. Magnetic flux. Magnetism of Matter. - Electromagnetic induction and self-induction. Induction current. Faraday and Lenz Laws. Self-inductance and inductance. Energy of a magnetic field associated to an inductor. - Maxwell equations. Propagation of electromagnetic waves.
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: Electrical circuits in transient regime
4.1	- Temporal evolution of the circuit state. First and second order circuits. Equations of energy storage elements. First order circuit analysis in transient regime. Circuits without excitation sources and non-zero initial conditions. Circuits with excitation sources and zero initial conditions. Circuits with excitation sources and non-zero initial conditions.
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: Introduction to Electronics
5.1	- Solid state physics. Bonds between atoms and molecules. Band theory in solids. Metals, semiconductors and insulators. Classification of Semiconductors. Concentration of charge carriers. Currents in Semiconductors. Manufacture of devices. - Semiconductor Devices I - Diodes. semiconductor diode - pn junction. Rectifier diode. Apliccations. - Semiconductor Devices II - Transistors. The Bipolar transistor BJT. Field Effect Transistors FET. The JFET transistor. The MOSFET transistor. Bipolar and CMOS technologies. Logic circuits. Apliccations.
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). Problems to be solved by groups, in order to practice with the material presented in class. A total of 5 sessions will be held. Grouping: groups of 2-4 students according to availability.
7	SIMULATION PRACTICES (PS). Introduction to the use of the NI Multisim circuit simulator to solve electrical and/or electronic circuits. A total of 5 practicals will be carried out. Grouping: individual.
8	BASIC ELECTRONIC PRACTICES (PEB). Introduction to the use of basic measuring instrumentation (multimeter and oscilloscope) and power supply (DC power supply and function generator) for electrical and/or electronic circuits typical of hardware laboratories. A total of 5 practicals will be carried out. Grouping: in pairs or individually.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Questions and/or problems relating to Theme block 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	Yes	10,00
Laboratoy Practices.	Laboratory evaluation	No	Yes	30,00
Final Exam	Written exam	Yes	Yes	0,00
Extraordinary Exam	Written exam	Yes	No	0,00
TOTAL				100,00

Observations

- 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 of the tests (written exams and laboratory internship exam) is 5.

* The tests are conducted without notes or books.

Observations for part-time students

- The obligation to attend and carry out all practices includes part-time students. As far as possible, and according to the teacher, it will be attempted to facilitate the follow-up of the rest of the subject.
- Part-time students must take the assessment tests at the end of the semester and, where appropriate, the extraordinary exam, which will constitute 60% of the Total Note. On the other hand, students who are unable to attend and carry out laboratory practices throughout the course, must take the examination corresponding to laboratory practices, which constitutes 30% of the Total Note. In addition, they will deliver throughout the course and in any case before the final evaluation, individual work proposed by the teacher whose evaluation will constitute 10% of the Total Note.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Serway - Jewett, "Física para Ciencias e Ingeniería", 7ª Edición, Vol. 2. CENGAGE Learning, 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.