SUBJECT TEACHING GUIDE

G703 - Electrical Engineering and Electric Machinery

First Degree in Industrial Technologies Engineering

Academic year 2025-2026

1. IDENTIFYING DATA					
Degree	First Degree in Industrial Technologies Engineering			Type and Year	Compulsory. Year 2
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Electrotechnics and Electrical Machines Module in Common with the Industrial Branch				
Course unit title and code	G703 - Electrical Engineering and Electric Machinery				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Knowledge Field	Industrial engineering, mechanical engineering, automation engineering, industrial organization engineering and navigation engineering				
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA ELECTRICA Y ENERGETICA
Name of lecturer	CRISTINA MENDEZ GUTIERREZ
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Other lecturers	LUIS FERNANDO MANTILLA PEÑALBA

4. OBJECTIVES

The ultimate objective of the course, in the Electrotechnics section, is for students to be able to apply the theory of three-phase systems. In addition, they should be able to apply circuit analysis methods under transient conditions. Finally, they will be capable of analyzing networks with non-sinusoidal periodic excitations and nonlinear loads. Students will also learn to interpret readings from fundamental measuring instruments, as well as those related to power quality.

In the Electrical Machines section, the final objective is for students to master the fundamental principles of electrotechnical devices that convert electrical energy into mechanical energy (and vice versa). This knowledge forms the conceptual foundation for the subsequent course, Electrical Machines and Drives. Specifically, students are expected to understand and apply both theoretical and practical aspects related to magnetic circuits, transformers, and electrical machines.

6. SUBJECT PROGRAM	
CONTENTS	
1	BT 1: THREE-PHASE CIRCUITS 1.1 Theoretical Content: Introduction. Generation of a three-phase system. Properties of interconnection between generators and loads. General analysis of three-phase networks. Three-phase power. Power measurement methods. Installations: power demand, power factor, equivalent apparent power. 1.2 Classroom Practice: Approach and problem-solving strategies for exercises and application problems. 1.3 Laboratory Practice: PL1. Familiarization with and operation of the three-phase load bench; measurement of active and reactive power. 1.4 Tutorial Activities: Clarification of theoretical and practical doubts, as well as review and resolution of exercises and problems proposed by the instructor, upon students' request. 1.6 Group Work: Resolution of problems derived from the measurements taken during laboratory sessions, in groups of three students.
2	BT 2: TRANSIENT CIRCUITS 2.1 Theoretical Content: Introduction. Classical study of first- and second-order circuits. Circuits with dependent sources. Inductive and capacitive divider circuits. Circuits with voltage or current impulses. Transient analysis using the Laplace method. 2.2 Classroom Practice: Approach and problem-solving strategies for exercises and application problems. 2.3 Laboratory Practice: PL2. Measurement and interpretation of transient signals. 2.4 Tutorial Activities: Clarification of theoretical and practical doubts, as well as review and resolution of exercises and problems proposed by the instructor, upon students' request. 2.6 Group Work: Resolution of problems derived from the measurements taken during the laboratory session, in groups of three students.
3	BT 3: NON-SINUSOIDAL REGIME CIRCUITS 3.1 Theoretical Content: Introduction. Fourier analysis. Solution of multi-frequency linear circuits. Harmonic sources. Harmonic transmission mechanisms. Analysis of nonlinear networks. Filtering. Power analysis in single-phase non-sinusoidal regime. 3.2 Classroom Practice: Approach and problem-solving strategies for exercises and application problems. 3.3 Laboratory Practice: PL3. Single-phase measurements under non-sinusoidal conditions. 3.4 Tutorial Activities: Clarification of theoretical and practical doubts, as well as review and resolution of exercises and problems proposed by the instructor, upon students' request. 3.5 Evaluation Test: EV1. 3.6 Group Work: Resolution of problems derived from the measurements taken during the laboratory session, in groups of three students.
4	BT 4: FUNDAMENTALS OF MAGNETISM AND MAGNETIC CIRCUITS 4.1 Theoretical Content: Introduction to magnetism. Magnetic materials. Laws of magnetic circuits. Magnetic circuits with constant excitation. Energy losses in ferromagnetic cores. Magnetic circuits with sinusoidal excitation. Principles of energy conversion. 4.2 Classroom Practice: Approach and problem-solving strategies for basic electrotechnical applications. 4.3 Computer-Based Practice: PL4. Simulation of magnetic circuits. 4.4 Tutorial Activities: Resolution of doubts and support for students requesting additional clarification or extended knowledge, upon their initiative. 4.6 Group Work: Resolution of problems derived from the computer-based practice, in groups of three students.
5	BT 5: FUNDAMENTALS OF ELECTRICAL MACHINES 5.1 Theoretical Content: Introduction to electrical machines. Transformer. Electromechanical energy conversion. 5.2 Classroom Practice: Approach and resolution of basic models of the main electrical machines. 5.3 Computer-Based Practice: PL5. Simulation of electrical machines. 5.4 Tutorial Activities: Resolution of doubts and support for students requesting additional clarification or extended knowledge, upon their initiative. 5.5 Evaluation Tests: EV3 and EV4. 5.6 Group Work: Resolution of problems derived from the computer-based practice, in groups of three students.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Continuous Assessment in Electrotechnics (CA1)	Written exam	No	Yes	42,50
Continuous Assessment in Electrical Machines (CA2)	Written exam	No	Yes	42,50
Final Exam (Official Examination Periods)	Written exam	Yes	Yes	0,00
Laboratory Sessions	Laboratory evaluation	No	No	10,00
Follow-up activities to be carried out during the semester classes.	Others	No	No	5,00
TOTAL				100,00

Observations

For the purposes of course assessment, the subject is divided into two equally weighted parts: the Electrotechnics Section and the Electrical Machines Section, in addition to a practical component and a series of follow-up activities to be carried out during the semester classes. Each section is assessed and graded independently.

The overall grade for the course will be obtained from the weighted average of the grades for each Section, along with the grades obtained in the laboratory practicals and the follow-up activities.

However, in order for the overall grade to be considered a passing mark, it is essential to have passed each Section independently. If one Section is passed and the other is not, even if the resulting arithmetic average is equal to or greater than 5, the final grade for the course will be 4.9 points (fail).

Likewise, failure to attend the assessment tests of any Section will result in a grade of ' Not Attended' ('No Presentado') for both that Section and the overall course grade.

If a student obtains a grade of 5 or higher in a Section in any of the assessment tests, that grade will be retained for subsequent assessment periods during the current academic year, and the student will be exempt from taking further exams in that Section.

Students who have not passed one or both Sections through Continuous Assessment will have the opportunity to retake them in the Final Exams during the official exam periods.

Observations for part-time students

Part-time students may choose either Continuous Assessment or the Final Exams during the Official Examination Periods.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

* Materiales teórico-prácticos suministrados por el profesor en la plataforma Moodle de la UC y en el Servicio de Reprografía de la Escuela.
* Eguíluz, L.I. 1986. "PRUEBAS OBJETIVAS DE INGENIERÍA ELÉCTRICA". Madrid. Ed. Alhambra. ISBN: 84-205-1257-5.
* Eguíluz, L.I. et al. 2001. "PRUEBAS OBJETIVAS DE CIRCUITOS ELÉCTRICOS". Pamplona. EUNSA. ISBN: 84-313-1888-0.
* Fraile, J. 2003 "MÁQUINAS ELÉCTRICAS". Madrid. Mc Graw Hill. ISBN: 84-481-3913-5.
* Mantilla, L. F. 2016. "FUNDAMENTOS DE TRANSFORMADORES ELÉCTRICOS Y MÁQUINAS ELÉCTRICAS ROTATIVAS". Santander. Universidad de Cantabria. ISBN:?.
* Pastor, A. et al. 2005. "CIRCUITOS ELÉCTRICOS". Volumen I y II. Madrid. UNED. ISBN: 84-362-4957-7.
* Sánchez, P. et al. 2007. "TEORÍA DE CIRCUITOS: PROBLEMAS Y PRUEBAS OBJETIVAS ORIENTADAS AL APRENDIZAJE". Madrid. Pearson Educación. ISBN: 978-84-8322-387-1.