

SUBJECT TEACHING GUIDE

G1976 - Energy Systems

Degree in Civil Engineering
First Degree in Civil Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering First Degree in Civil Engineering			Type and Year	Compulsory. Year 3 Compulsory. Year 3
Faculty	School of civil Engineering				
Discipline	Energy Systems				
Course unit title and code	G1976 - Energy Systems				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA ELECTRICA Y ENERGETICA
Name of lecturer	JOSE RAMON ARANDA SIERRA
E-mail	jose.aranda@unican.es
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO PROFESOR (S3032)
Other lecturers	FRANCISCO JAVIER BALBAS GARCIA CARMELA ORIA ALONSO

3.1 LEARNING OUTCOMES

- Knowledge of the fundamentals of single-phase and three-phase electrical circuits and the different types of power associated with them, as well as the ability to calculate, measure, and control the values of electrical quantities in general.
- Knowledge of the structure and operation of electrical machines: as well as their performance and losses, especially for transformers.
- Understanding the behavior of an electrical power system and the different types of power plants.
- Ability to design and calculate a Low Voltage power line in accordance with current regulations.
- Capacity for the design and initially calculate a Low Voltage electrical installation , especially for a building, in accordance with current regulations.

4. OBJECTIVES

Through this subject, the student will learn the fundamentals of electrical circuits and machines and apply them to understand and calculate the behavior of power plants and Low Voltage electrical installations , as well as the principles of instrumentation and control using programmable logic controllers.

6. SUBJECT PROGRAM

CONTENTS

1	Fundamentals of Electrotechnics
1.1	Maxwell's Equations. Poynting Vector Lorentz Force Electrical Parameters: Resistance, Reactance, Capacitance. Voltage and Current Sources
1.2	Single-phase Alternating Current Electrical Circuits
1.3	Three-phase Alternating Current Electrical Circuits.
2	General Aspects of Electrical Machines. Transformers.
2.1	Magnetic Materials. Magnetic Circuits. Magnetic Losses. Description of an Electrical Machine. Magnetic Field. Ferraris' and Leblanc's Theorems. Operating Principles of Classical Machines. Losses and Efficiency. Thermal Class of Insulation. Assigned Values. IP and IK Codes
2.2	Single-phase and Three-phase Transformers. Equivalent Circuit. Autotransformers and Instrument Transformers
3	Electrical Installations
3.1	Instrumentation and Applied Automation <ul style="list-style-type: none"> • Sensors and Actuators • Programmable Logic Controllers • Applications in Civil Engineering
3.2	Low Voltage Electrical Regulation. Switching and Protection Equipment. Grounding Systems
4	Electrical Energy. Power Plants. Power Systems.
4.1	General Aspects of Electrical Generation. Spanish Electrical Sector.
4.2	Conventional Power Plants (Thermal, Nuclear, and Combined Cycle).
4.3	Renewable Power Plants (Hydraulic, Wind, Solar Thermal, Biomass, Photovoltaic).
5	Electrical Lines.
5.1	Insulating and Conducting Materials. Parameters. Calculation of Conductor Cross-section by Maximum Admissible Current and Voltage Drop.
5.2	Practical Cases. Software Applications.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Laboratory practices Date of Execution: During the academic term Recovery conditions: Laboratory Practices are not recoverable.	Laboratory evaluation	Yes	No	20,00
Activities first part Completion date: During the school period, at the end of Block 2 of contents Recovery conditions: are not recoverable.	Others	Yes	No	5,00
First partial written test. Written exam. Completion date: During the school period, at the end of Block 2 of contents. Recovery conditions: Recoverable through the final exams (ordinary and extraordinary calls).	Written exam	Yes	Yes	35,00
Second part activities: Date of completion: During the school period Recovery conditions: are not recoverable.	Others	Yes	No	5,00
Second partial written test. Written exam. Completion date: During the school period, at the end of Block 5 of contents. Recovery conditions: Recoverable through final exams (ordinary and extraordinary calls).	Written exam	Yes	Yes	35,00
TOTAL				100,00
Observations				

The course is divided into two parts:

- 1st part: Topics 1 and 2.
- 2nd part: Topics 3, 4 and 5.

The exam for each part will be in writing, with theory questions (T) and problems (P). The EP grade will be the weighted sum of the respective notes (T+P), provided that none of them is less than 30% of the maximum of the corresponding sum.

The Final Grade of the Subject is calculated using this expression:

$$5\% A1 + 35\% EP1 + 5\% A2 + 35\% EP2 + 20\% L$$

A1 note of the activities of the first part.

EP1 is the best of the marks obtained for the first part of the subject in the midterm and final exams.

A2 note of the activities of the second part.

EP2 is the best of the marks obtained for the second part of the subject in the midterm and final exams.

L is the note of the laboratory practices.

To pass the course you must obtain a Final Subject Grade equal to or greater than 5 (out of 10) and ensure that none of the EP1 and EP2 grades of both parts of the subject are less than 4 (out of 10).

Students who, after a partial exam, have obtained a grade equal to or greater than 4 (out of 10) in one of the parts of the course do not need to take the exam for that part in the Final Exam. This gives the possibility of passing the subject during the course, without having to take the Final Exams.

Students who have not passed the subject after the ordinary call for the Final Exam, but have obtained a grade equal to or greater than 4 (out of 10) in one of the parts do not need to take this part in the extraordinary call for the Final Exam.

The notes of each of the parts of the subject are saved until the extraordinary call for the Final Exam inclusive, but not for the following courses.

In relation to the agreements adopted in the ordinary session of the School Board held on June 10, 2010, it is established that, with respect to the evaluation activities that are recoverable,

- As a general criterion, and unless something else is specified in this guide, a student may only take the recovery of those activities that he has not passed, that is, in which he has not obtained a minimum grade of five out of ten.
- As a general criterion, and unless otherwise specified in this guide, in the recovery period the evaluation procedure for an activity will be the same as that of the activity that originates it.

Observations for part-time students

Part-time students will have the same conditions as the rest of the students.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

"Electrotecnia para ingenieros". Fraile Mora, Jesús. 2023. Madrid: Ibergarceta Publicaciones SL. ISBN 978-84-1903-414-4.

"Máquinas eléctricas". Fraile Mora, Jesús. 2016. Madrid: Ibergarceta Publicaciones SL. ISBN 978-84-1622-866-9.

"Electromagnetismo y circuitos eléctricos". Fraile Mora, Jesús. 2005. Madrid: McGraw-Hill/Interamericana de España. ISBN 84-4819-843-3.

"Electrotecnia básica para ingenieros". Gurrutxaga Ruiz, José Antonio. 1997. Santander. Servicio de Publicaciones de la Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos. ISBN 84-89627-01-0.

"Centrales eléctricas. Enciclopedia CEAC de la Electricidad". Ramírez Vázquez, José. 1995. Barcelona. CEAC. ISBN 84-329-6006-3.

GUIONES DE CLASE Y DE PRÁCTICAS DE LABORATORIO. Aranda Sierra, José Ramón y Rodríguez Pozueta, Miguel Ángel