

## SUBJECT TEACHING GUIDE

G1976 - Energy Systems

Degree in Civil Engineering

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering			Type and Year	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				
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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 and three-phase electrical circuits and of the different types of power associated with them and the ability to calculate, measure and control the values of electrical quantities in general.
- Knowledge of the constitution and operation of electrical machines: as well as their performance and losses, especially for transformers.
- Understanding of the behavior of an electrical power system and the different types of power plants.
- Ability to design and calculate a Low Voltage power line taking into account current regulations.
- Capacity for the design and initial calculation of a Low Voltage electrical installation, especially for a building, according to what is indicated in the 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.

#### 6. COURSE ORGANIZATION

##### CONTENTS

1	Fundamentals of Electrotechnics
1.1	Maxwell's equations. Poynting vector Lorentz force Electrical Parameters: Resistance, Reactance, Capacity 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 theorems. Principle of operation of classical machines. Losses and performance. Thermal class of insulation. Assigned values. IP and IK codes
2.2	Monophasic and triphasic transformers. Equivalent circuit. Autotransformers and measurement transformers.
3	Electrical installations
3.1	Instrumentation and applied automation. - Sensors and actuators. - Programmable controllers. - Applications in civil engineering.
3.2	Low Voltage Electrotechnical Regulation. Switchgear and protection switchgear. Ground sockets.
4	Electric power. Power plants. Electrical power systems.
4.1	General aspects of electricity generation. Spanish Electric Sector.
4.2	Conventional power plants (thermal, nuclear and combined cycle).
4.3	Renewable power plants (hydraulic, wind, solar thermal, biomass, photovoltaic).
5	Power lines.
5.1	Insulating and conductive materials. Parameters. Calculation of the section of the conductor by maximum admissible intensity and by voltage drop.
5.2	Practical cases. computer applications

## 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
<p>Description Laboratory practices The note of this section will take into account the participation and involvement of the student during the Laboratory Practices and the report of each practice that must be delivered later. Laboratory Practices are not re</p>	Laboratory evaluation	Yes	No	20,00
<p>Description Activities first part Completion date: During the school period, at the end of Block 2 of contents Recovery conditions: Recoverable through final exams (ordinary and extraordinary calls). Observations: For continuous evaluation, it will be del</p>	Others	Yes	Yes	5,00
<p>Description First partial written test This partial exam covers topics 1 and 2. Students who have obtained a grade of no less than 4 (out of 10) in this partial exam do not need to take an exam for this part of the subject in the Final Exams.</p>	Written exam	Yes	Yes	35,00
<p>Description: Second part activities: Date of completion: During the school period Recovery conditions: Recoverable through final exams (ordinary and extraordinary calls). Observations: For the evaluation by course, it will be delivered before the exam of</p>	Others	Yes	Yes	5,00
<p>Description Second test: written Completion date: During the school period, at the end of Block 5 of contents Recovery conditions: Recoverable through final exams (ordinary and extraordinary calls). Observations: This partial exam covers topics 3, 4 and 5</p>	Written exam	Yes	Yes	35,00
<b>TOTAL</b>				<b>100,00</b>
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.

Note 1: According to royal decree RD 1125/2003 on the European credit system and the grading system in official university degrees valid throughout the national territory, the results obtained by the student in each of the subjects of the The study plan will be graded according to the following numerical scale from 0 to 10, with the expression of a decimal, to which the corresponding qualitative grade may be added:

0.0-4.9: Failed (SS).

5.0-6.9: Approved (AP).

7.0-8.9: Remarkable (NT).

9.0-10: Outstanding (SB).

NOTE 2: "Only for duly justified reasons (eg health restrictions) the assessment tests may be organized remotely, with the prior authorization of the Center Management".

#### 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

FRAILE MORA, J. "Electromagnetismo y circuitos eléctricos". Mc Graw-Hill/Interamericana de España. Madrid.

FRAILE MORA, J. "Máquinas Eléctricas". Mc Graw-Hill/Interamericana de España. Madrid.

FRAILE MORA, J. "Introducción a las Instalaciones Eléctricas". Colegio de Ingenieros de Caminos, Canales y Puertos.

CEAC. "Centrales eléctricas. Enciclopedia CEAC de la electricidad".

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

