

## SUBJECT TEACHING GUIDE

G1132 - Energy Systems

Degree in Civil Engineering

Academic year 2021-2022

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering			Type and Year	Compulsory. Year 3
Faculty	School of civil Engineering				
Discipline	Subject Area: Energy Systems Module: Training in Applied Technology				
Course unit title and code	G1132 - 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 and three-phase electrical circuits and 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 of 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 of a building, according to what is indicated in current regulations.

#### 4. OBJECTIVES

Through this subject, the student will learn the fundamentals of electrical circuits and machines and will 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 automatons.

#### 6. COURSE ORGANIZATION

CONTENTS	
1	Fundamentals of Electrical Engineering
1.1	Maxwell's equations. 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 classic machines. Losses and performance. Thermal class of insulation. Assigned values. IP and IK codes.
2.2	Mono and three-phase transformers. Equivalent circuit. Autotransformers and instrument transformers.
3	Electrical installations
3.1	Instrumentation and applied automation. - Sensors and actuators. - Programmable automatons. - Applications in civil engineering.
3.2	Low Voltage Electrotechnical Regulation. Switchgear and protection equipment. Grounding.
4	Electric power. Power stations. Electrical power systems.
4.1	General aspects of electricity generation. Spanish Electricity 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 conductor section by maximum admissible current and by voltage drop.
5.2	Practical cases. Computer applications

### 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Description Laboratory practices	Laboratory evaluation	Yes	No	20,00
Description First partial activities	Others	Yes	Yes	5,00
Description First partial written test	Written exam	Yes	Yes	35,00
Description Second partial activities	Others	Yes	Yes	5,00
Description Second partial written test	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. Scheduled for 11-5-2021
- 2nd part: Topics 3, 4 and 5. Scheduled for 12-15-2021

The exam for each part will be in writing, with some theory questions (T) and some problems (P). The EP rating will be the weighted sum of the respective grades (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 quarter.

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 quarter.

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

L is the grade for the labs.

To pass the course, you must obtain a Final Grade of the Subject equal to or greater than 5 (out of 10) and ensure that none of the EP1 and EP2 grades for both parts of the course 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 that part in the Final Exam. This gives the possibility of passing the course during the course, without having to take the Final Exams.

Students who, after the ordinary call for the Final Exam, have not passed the course, 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 marks of each of the parts of the subject are kept until the extraordinary summons of 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 different is specified in this guide, a student may only appear for recovery of those activities that have not been passed, that is, in which they have not obtained a minimum grade of five out of ten.
- As a general criterion and unless something different is specified in this guide, in the recovery period the evaluation procedure of 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 system of qualifications in university degrees of an official nature and valid throughout the national territory, the results obtained by the student in each of the subjects of the Curriculum will be graded according to the following numerical scale from 0 to 10, with an expression of one decimal place, to which the corresponding qualitative qualification may be added:

0.0-4.9: Suspense (SS).

5.0-6.9: Pass (AP).

7.0-8.9: Notable (NT).

9.0-10: Excellent (SB).

NOTE 2: 'Only for duly justified reasons (eg sanitary restrictions) the evaluation tests may be organized remotely, with prior authorization from the Center's 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 Angel Rodríguez Pozueta y José Ramón Aranda Sierra.

