

## 30019 - Electrical Machines

### Syllabus Information

**Academic Year:** 2021/22

**Subject:** 30019 - Máquinas eléctricas

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 436 - Bachelor's Degree in Industrial Engineering Technology

**ECTS:** 6.0

**Year:** 2

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:**

### 1. General information

### 2. Learning goals

### 3. Assessment (1st and 2nd call)

### 4. Methodology, learning tasks, syllabus and resources

#### 4.1. Methodological overview

The learning process that has been designed for this subject is based on the following:

The learning process has been designed to promote the student's continued work and focuses on the basic theoretical aspects in order to understand, analyze and apply that knowledge to solving real problems.

For the development of the subject, on the one hand theoretical sessions will be taught with the whole group, in which the theoretical foundations of the subject will be exposed in the form of a master class and will be complemented with the resolution of problems-type.

On the other hand, laboratory sessions will be held in small groups where the student will work as a member of a group of two or three students. The purpose of the practices is to apply the knowledge acquired in the theoretical sessions, focusing on assemblies of circuits, electrical measurements and the connection and use of electrical machines. With laboratory practices, the student is expected to know electrical appliances and machines, acquire manual skills, and reinforce the theoretical knowledge acquired.

There will also be various written control tests, distributed throughout the school period.

#### 4.2. Learning tasks

The program offered to the student to help him achieve the expected results includes the following activities:

Classes (45 hours). On the one hand, exposition sessions and explanation of theoretical contents will be held, related to the different types of electrical machines (construction parts, operating principles, connection, etc.). On the other hand, and in a coordinated manner, problems and practical cases related to the theoretical expositions will be developed. The student will have teaching material prepared by the faculty, and available in Moodle (<https://moodle2.unizar.es/add/>).

Laboratory practices (15 hours). The student will have scripts of practices, available in Moodle (<https://moodle2.unizar.es/add/>), which must be read before each session.

Individual study (81 hours), distributed throughout the 15 weeks of the course. The student's continued work will be encouraged through the homogeneous distribution of the different learning activities throughout the semester.

Evaluation tests (from 6 to 9 hours). In addition to having a qualifying function, the evaluation is also a learning tool with which the student checks the degree of understanding and assimilation of knowledge and skills achieved.

### 4.3. Syllabus

The program of the planned subject is divided into three main blocks, in which the concepts on Electrical Machines are developed.

Transformers:

Introduction. Ideal transformer. Constructive aspects of the real transformer. Reduction from 2nd to 1st. Equivalent circuit. Performance. Three-phase banks. Three-phase transformers. Hourly indexes. Transformers in parallel. Autotransformers. Measurement and protection transformers.

Asynchronous machines:

Introduction. Constructive aspects, cage rotor and winding rotor. Rotating magnetic fields. Principle of operation as motor, brake, generator. Equivalent circuit. Balance of powers. Mechanical characteristic. Start of the asynchronous motor. Speed variation of the asynchronous motor.

Synchronous machines.

Introduction. Constructive aspects. Excitation systems. Operating principle of an alternator. Operation in vacuum, load operation. Induced reaction. Phasorial diagram. Linear analysis of the synchronous machine. Behn-Eschenburg method. Equivalent circuit. Operating in a network of infinite power. Operating in an isolated network.

### 4.4. Course planning and calendar

Calendar of face-to-face sessions and presentation of works:

The lectures and problems and the practical sessions in the laboratory are taught according to the schedule established by the center (schedules available on their website).

Each teacher will inform of their tutoring attention schedule.

The rest of activities will be planned according to the number of students and will be announced well in advance. It will be available on Moodle (<https://moodle2.unizar.es/add/>).

It is a subject of 6 ETCS credits, which is equivalent to 150 hours of student work, to be done in both face-to-face and non-contact hours, distributed as follows:

- 45 classroom hours, distributed in 3 hours per week. In them the exposition of theoretical contents will be carried out, and problems and practical cases coordinated with the theoretical expositions will be developed.
- 15 hours of laboratory practices, divided into several sessions, throughout the semester.
- 81 hours of personal study, distributed throughout the 15 weeks of the course.
- 3 to 6 hours of control tests, distributed in theoretical-practical tests distributed throughout the semester.
- 3 hours of exam, corresponding to the official call

The list of dates and specific activities, as well as all types of information and documentation about the subject, will be published in Moodle (<https://moodle2.unizar.es/add/>) (for access to this website, the student must be enrolled)

### 4.5. Bibliography and recommended resources

Link:

[http://biblos.unizar.es/br/br\\_citas.php?codigo=30019&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=30019&year=2019)