

60813 - Electrical machinery

Syllabus Information

Academic year: 2024/25

Subject: 60813 - Electrical machinery

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 532 - Master's in Industrial Engineering

ECTS: 6.0

Year:

Semester: First semester

Subject type: Optional

Module:

1. General information

The subject and its expected results respond to the following approaches and objectives:

The subject is aimed at the acquisition of basic knowledge about rotating electrical machines and both single-phase and three-phase transformers, and about their need and use in energy transformation processes.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda (and certain specific goals, in such a way that the acquisition [of https://www.un.org/sustainabledevelopment/es/](https://www.un.org/sustainabledevelopment/es/)) the learning results of the subject provides training and competence to the student to contribute to a certain extent to their achievement:

- Goal 7. Affordable and non-polluting energy

Objective 7.3: By 2030, double the global rate of improvement in energy efficiency

2. Learning results

Upon completion of the subject, the student will be able to:

BASIC SKILLS

CB10. Possess the learning skills that allow them to continue studying in a way that will largely be self-directed or autonomous.

GENERAL SKILLS

CG1. Have adequate knowledge of the scientific and technological aspects of: mathematical, analytical and numerical methods in engineering, electrical engineering, energy engineering, chemical engineering, mechanical engineering, mechanics of continuous media, industrial electronics, automatic electronics, manufacturing, materials, quantitative management methods, industrial computing, urban planning, infrastructure, etc.

CG10. Communicate their conclusions and the ultimate knowledge and rationale behind them to specialized and non-specialized audiences in a clear and unambiguous manner.

CG11. Possess learning skills that allow for continued study in a self-directed or autonomous manner.

CG12. Know, understand and apply the necessary legislation as an industrial engineer.

SPECIFIC SKILLS

CE3. Calculate and select electrical machines.

3. Syllabus

The subject's program is divided into four main blocks, in which concepts about electric machines are developed. Therefore, the syllabus is distributed as follows.

Transformers:

Introduction. Ideal transformer. Constructive aspects. Real transformer. Equivalent circuit. Performance. Three-phase transformers. Hourly indices. Parallel transformers. Autotransformers. Measurement and protection transformers.

Asynchronous machines:

Introduction. Constructive aspects, cage rotor and wound rotor. Rotating magnetic fields produced by a single-phase and three-phase system. Operating principle as motor, brake, generator. Equivalent circuit. Power balance. Mechanical characteristic. Asynchronous motor startup. Speed regulation of the asynchronous motor.

Synchronous machines:

Introduction. Constructive aspects. Operating principle of an alternator. Operation in vacuum, operation under load. Induced reaction. Phasor diagram. Equivalent circuit. Operation in an infinite power network. Operation on an isolated network.

DC machines:

Introduction. Constructive aspects. Operating principle. DC motors DC Generators

4. Academic activities

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

Theoretical-practical classes (45 hours). On the one hand, sessions will be held for the presentation and explanation of theoretical content, related to the different types of electric machines (constructive parts, operating principles, wiring, etc.). The student will have teaching material prepared by the teaching staff, and available in the Teaching Digital Ring (<http://moodle.unizar.es/>), to help them follow the theoretical classes. On the other hand, and in a coordinated manner, practical problems and cases related to theoretical presentations will be developed (calculation of circuits, analysis of the operation of electrical machines, etc.).

Laboratory practices (15 hours). The student will have the scripts for each practice available in the Teaching Digital Ring (<http://moodle.unizar.es/>), which must be read prior to each session, and in which to make notes about the activities carried out.

Individual study (87 hours of independent work), spreads over the 15 weeks of the subject's duration. The continuous work of the student will be encouraged through the homogeneous distribution throughout the semester of the various learning activities.

Assessment tests (3 hours) In addition to having a grading function, evaluation is also a learning tool that helps the student check the degree of understanding and assimilation of knowledge and skills achieved.

5. Assessment system

The student must demonstrate achievement of the intended learning results through the following assessment activities:

- Laboratory practices (20% of the final grade): Each practice will be evaluated separately. The grade will be based on the work done by the student in each practice session. For this purpose, it will be necessary for the student to present a final report, filling out a questionnaire that the teacher will give them before the end of the session. Not attending a practice session will result in a zero for that session, and the student will have to make it up by passing the practical exam. To pass the subject, it is necessary to attend all the practices or obtain a minimum grade of 5 out of 10 in the practical exam.

- Call for exams (80% of the final grade): It will consist of a written test, to be carried out during the exam period, with a part corresponding to short questions and another to problem solving. Each part represents 50% of the exam grade, and it is necessary to obtain a minimum score of 3.5 out of 10 in each of them in order to average. A minimum grade of 4 out of 10 is required to pass the subject.

Those students who do not complete the proposed evaluation tests throughout the semester, may choose to pass the subject through the evaluation tests that will be scheduled on the dates of the official exam calendar of the centre and for each of the two calls, consisting of:

- Call for examination (80% of the final grade): written test of the same characteristics as in the ordinary evaluation.

- Practical Exam (20% of the final grade): laboratory test where the student will demonstrate that they are capable of performing any of the sections proposed in the practical scripts. For this exercise, the student may use their practice notebook.

To pass the subject in each of these two evaluation tests, it is necessary to obtain a minimum grade of 5 out of 10.

6. Sustainable Development Goals

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