3200211 - ME1 - Electrical Machines I

Degree competences to which the subject contributes

Specific:
1. ELE: Ability to calculate and design electrical machines.

Learning objectives of the subject

This subject introduces students to the operation, construction, application and selection principles of electric machines (both static and rotating), as well as the design of basic parts that are common to all such machines. Students will learn to use the parameters that govern the various types of machines and interpret their characteristic curves. They will use commercial catalogues and rated quantities to determine the performance of different machines and select the most appropriate one. They will also learn to interpret and use graphic methods, recommended by international standards, for construction, use and start-up tests.

Students will learn to solve problems related to the behaviour of electric machines (generators, transformers and engines) both analytically and graphically, paying special attention to the order of magnitude and the units used in industry. They will use construction plans and diagrams to better understand the operation and configuration of the various circuits (magnetic, electric, dialectic, etc.) and their topology.

Prior skills

Students will be expected to have passed Physics and Electrical Systems, since the knowledge acquired in those subjects is the foundation on which an understanding of electric machines will be built.

Teaching methodology

In the lecture sessions, the lecturer presents the subject content. He/she covers the various concepts, explains what documentation will be used and assigns work.

In the face-to-face applied sessions, groups of three students present the results of their completed assignments. The lecturer decides which students will participate in each of these sessions.

Independent learning enables students to gain an understanding of each of the concepts covered by the lecturer. This type of learning also includes the completion of assignments.

Group work, done in three-person teams, includes preparation for practicals and the writing of post-practical reports.

Teaching staff

Coordinator: Ricard Horta Bernús
### Study load

<table>
<thead>
<tr>
<th><strong>Total learning time:</strong> 150h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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# Content

## TOPIC 0: INTRODUCTION

**Description:**
- 0.01. Background on electric machines. Documentation.
- 0.02. General information on electric machines.

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>3h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>3h</td>
</tr>
</tbody>
</table>

## TOPIC 1: TRANSFORMERS

**Description:**
- 1.01. Basic principles of transformers.
- 1.02. The study of real transformers.
- 1.03. Equivalent circuits in transformers.
- 1.04. Energy balance in a transformer.
- 1.05. Polyphase transformers.
- 1.06. Transformer coupling.
- 1.07. Autotransformers.
- 1.08. Measurement transformers.
- 1.09. Special transformers.
- 1.10. Additional topics.

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>71h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>12h</td>
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<td>Practical classes:</td>
<td>7h</td>
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<td>Laboratory classes:</td>
<td>7h</td>
</tr>
<tr>
<td>Self study:</td>
<td>45h</td>
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**Related activities:**
- Three sessions.
- Testing of single-phase transformers to obtain their characteristic parameters and equivalent circuit.
- Testing of three-phase transformers to obtain their characteristic parameters and equivalent circuit.
- Students use current and voltage transformers to take measurements.
- Paralleling of single-phase and three-phase transformers.
- Determination of transformer winding polarity.
TOPIC 2: SYNCHRONOUS ALTERNATING-CURRENT MACHINES

Description:
2.01. Basics of synchronous machines.
2.02. Characteristics of synchronous machines.
2.03. Excitation and voltage drops.
2.04. Alternator coupling.
2.05. Synchronous engines.
2.06. Additional topics.

Related activities:
Two sessions.
- Testing of synchronous generators to obtain their characteristic parameters and equivalent circuit.
- Parallel coupling of synchronous generators and network connections.

Qualification system

- Exam 1: 20%
- Exam 2: 20%
- Exam 3: 20%
- Exam 4: 20%
- Exam laboratory: 20%

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.
Bibliography

Basic:


Complementary:


