820127 - ME1EE - Electrical Machines I

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff
Coordinator: Ramon Bargalló Perpiñà
Others: Ramon Bargalló Perpiñà, Altres

Prior skills
Differential and Integral calculus
Matrix calculus
ODE
Complex number algebra
Electromagnetics
DC and AC circuit analysis
Scientific calculator use (HP 50G and CFX-9950)

Requirements
Electricas Systems course

Degree competences to which the subject contributes
Specific:
1. Carry out calculations for the design of electrical machines.

Transversal:
3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

Teaching methodology
Expositive methodology for theory classes.
PBL for exercises classes.
Normalized test on laboratory classes.

Learning objectives of the subject
Electromagnetic laws application to electromechanical conversion and coupled circuit analysis applied to industrial power transformer and rotating electrical machines.
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<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<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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Total learning time: 150h
### Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time:</th>
<th>Theory classes:</th>
<th>Laboratory classes:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Transformer introduction</strong></td>
<td>14h</td>
<td>5h</td>
<td>2h</td>
<td>7h</td>
</tr>
<tr>
<td><strong>Three phase transformers</strong></td>
<td>23h</td>
<td>7h</td>
<td>5h</td>
<td>11h</td>
</tr>
<tr>
<td><strong>Special Transformers</strong></td>
<td>8h</td>
<td>3h</td>
<td>5h</td>
<td></td>
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<tr>
<td><strong>Electromechanical energy conversion.</strong></td>
<td>10h</td>
<td>4h</td>
<td>6h</td>
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**Description:**

**Related activities:**
- Heating test for a transformer
- Normalized test of single phase transformer.
- Tests on three phase transformers. Rotation angle determination

**Description:**
- Three phase transformer construction. Three limbs transformers. Rotation of phases.


**Description:**
### AC machines: fundamentals.

<table>
<thead>
<tr>
<th>Learning time: 25h</th>
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</thead>
<tbody>
<tr>
<td><strong>Theory classes:</strong> 7h</td>
</tr>
<tr>
<td><strong>Self study:</strong> 18h</td>
</tr>
</tbody>
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**Description:**
- Elemental Alternating Current generator. Windings. EMF, distribution, short pitching and winding factor.
- Harmonic effects. Magnetic field on airgap. Rotating field theory.

### Asynchronous machine: motor

<table>
<thead>
<tr>
<th>Learning time: 42h</th>
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</thead>
<tbody>
<tr>
<td><strong>Theory classes:</strong> 13h</td>
</tr>
<tr>
<td><strong>Laboratory classes:</strong> 4h</td>
</tr>
<tr>
<td><strong>Self study:</strong> 25h</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
- Normalized test for losses segregation. Equivalent circuit determination.
- Normalized test for mechanical characteristic determination.

### Asynchronous machine: special applications.

<table>
<thead>
<tr>
<th>Learning time: 28h</th>
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<tbody>
<tr>
<td><strong>Theory classes:</strong> 6h</td>
</tr>
<tr>
<td><strong>Laboratory classes:</strong> 4h</td>
</tr>
<tr>
<td><strong>Self study:</strong> 18h</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
- Single phase motor: start up. Mechanical characteristic determination.
- Asynchronous generator: Autonomous work. Infinite bus work.

### Qualification system

Final test: 20%
Laboratory: 20%
Homework exercicis+classe exercises: 20%
middle term exam: 20+20%
Regulations for carrying out activities

Scientific calculator
1 sheet with expressions.
Continuous evaluation, no final reexam.

Bibliography

**Basic:**


**Complementary:**