820128 - ME2EE - Electrical Machines II

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6

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

Prior skills
Differential and Integral calculus
Matrix calculus
Numerical resolution of ODE
Complex number algebra
Electromagnetics
DC and AC circuit analysis
Transient circuit analysis (1st and 2n order)
Scientific calculator use (HP 50G and CFX-9950)
Some knowledge of MATLAB/OCTAVE

Requirements
Electrical machines 1.

Degree competences to which the subject contributes
Specific:
1. Carry out calculations for the design of electrical machines.
CEELE-20. Understand machine control and electric drives and their applications.

Transversal:
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

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

Learning objectives of the subject
Electrical machines analysis feeds with industrial grid or ideal electronic converter.
Non conventional machines analysis
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Transient analysis of AC machines
Introduction to design of electrical machines

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time:</td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# Content

<table>
<thead>
<tr>
<th>Synchronous machines: Generator operation</th>
<th>Learning time: 31h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study : 19h</td>
</tr>
<tr>
<td>Test of generator. No load test. Short circuit test.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Synchronous machine: motor operation</th>
<th>Learning time: 26h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study : 16h</td>
</tr>
<tr>
<td>Grid Synchronization of synchronous generator. Working as a motor. Constant power characteristics.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non conventional machines</th>
<th>Learning time: 36h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 12h</td>
</tr>
<tr>
<td>Electromechanical energy conversion principles. Study of lineal and rotating systems. Multiple excitation systems. Torque. Switched reluctance machines. Step motors. Linear motors. Other.</td>
<td>Laboratory classes: 3h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study : 21h</td>
</tr>
<tr>
<td>Step motor test.</td>
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<tr>
<td>Asynchronous linear motor test</td>
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</tbody>
</table>
### Direct current machines

**Description:**

**Related activities:**
- DC generator test
- DC motor test

**Learning time:** 16h  
Theory classes: 5h  
Laboratory classes: 2h  
Self study: 9h

### Transients and Dynamics of electrical machines

**Description:**

**Related activities:**
- Starting of induction machine
- Simulation
- Experimental test

**Learning time:** 17h  
Theory classes: 5h  
Laboratory classes: 2h  
Self study: 10h

### Design of electrical machines

**Description:**
General expressions for torque. Standards. Scale laws. FE applications for analysis and design of electrical machines

**Related activities:**
- FE analysis of electrical machine

**Learning time:** 24h  
Theory classes: 5h  
Laboratory classes: 4h  
Self study: 15h

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**Qualification system**

Final test: 20%  
Laboratory: 20%  
Homework exercises + class exercises: 15%  
Middle term exam: 20 + 20%
Regulations for carrying out activities

Scientific calculator
1 sheet with expressions. No reexam.

Bibliography

Basic:


Complementary: