Course guides
820751 - AEER - Electric Drives with High Efficiency and Low Environmental Impact

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.
Degree: Academic year: 2020   ECTS Credits: 5.0
Languages: Catalan, Spanish

LECTURER
Coordinating lecturer: Andrada Gascon, Pedro
Others: Perat Benavides, Jose Ignacio
        Torrent Burgues, Marcel
        Blanqué Molina, Balduino

PRIOR SKILLS
Basic knowledge of machines and electrical drives.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>24.00</td>
</tr>
<tr>
<td>Self study</td>
<td>85,0</td>
<td>68.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>8.00</td>
</tr>
</tbody>
</table>

Total learning time: 125 h
CONTENTS

1.- Electric drives.

**Description:**
1.1. Definition and design of electric drives.
1.2. Types of electric drives.
1.3. Applications as power range.

**Specific objectives:**
Describe the different parts of the electric drives. Know their uses in different power ranges.

**Related activities:**
Classes of problems in the classroom

**Full-or-part-time:** 8h
Theory classes: 2h
Guided activities: 1h
Self study : 5h

2.- Efficiency, environmental and economic considerations in electric drives

**Description:**
2.2. Performance improvement opportunities.
2.3. Variable speed and energy saving.
2.4. Environmental considerations. Life cycle assessment (LCA)
2.7. Economic considerations (Payback, VAN, TIR).

**Specific objectives:**
Identify the different parameters of energy-saving electric motors and drives.
Explain losses in the motors and electric drives.
Apply a methodology for calculating the energy, environmental and economic evaluation of motors and electric drives.

**Related activities:**
Class of problems in the classroom
Practical application of the MEEUP methodology on an electric drive.

**Full-or-part-time:** 14h
Theory classes: 4h
Guided activities: 2h
Self study : 8h
### 3.- Three-phase induction motor drives

**Description:**
- Phase induction motors. Analysis of losses.
- Energy efficiency classes.
- Drives with three-phase induction motors, strategies to improve performance.
- Drives with induction motors, optimal control of energy.

**Specific objectives:**
Study and show the potential of the drives with three-phase induction motors and high-performance drives.

**Related activities:**
Class of problems in the classroom.

**Full-or-part-time:** 14h
- Theory classes: 6h
- Guided activities: 7h
- Self study: 1h

### 4.- Permanent magnet synchronous motor drives

**Description:**
- Overview of permanent magnets.
- Synchronous drives with permanent magnets. Classification.
- Synchronous motors of reluctance.
- Continuous current motors, brushless (Brushless D.C. motors)

**Specific objectives:**
Study and show the potential of the different types of drives with synchronous motors and high-performance drives.

**Related activities:**
Class of problems in the classroom.

**Full-or-part-time:** 20h
- Theory classes: 8h
- Guided activities: 10h
- Self study: 2h

### 5.- Switched reluctance motor drives

**Description:**
- Constitution and operation principles.
- Reluctant magnetic structure, power electronic converter and position sensors.
- Modelling and control.
- Simulation of auto switched reluctance drives.

**Specific objectives:**
Study and show the potential of drives with auto switch reluctance motors as drives for high performance.

**Related activities:**
Class of guided problems in the classroom
- Two practices of modelling and simulation of auto switch reluctance drives

**Full-or-part-time:** 14h
- Theory classes: 4h
- Guided activities: 2h
- Self study: 8h
ACTIVITIES

Assignments

Description:
An individual or group work on some aspect of performance improvement or environmental impact of a specific drive will be performed. The work is to be submitted in class.

Specific objectives:
Deepening of any of the topics of the course.
Teamwork.
Improving oral and written expression.
Solvent use of information.

Full-or-part-time: 45h
Self study: 45h

Practices

Description:
Practice I. Application of MEEUP methodology to a case of an electric drive.
Practice II. Simulation of auto switch reluctance drives I.
Practice III. Simulation of auto switch reluctance drives II.

Full-or-part-time: 10h
Guided activities: 6h
Self study: 4h

GRADING SYSTEM

Attendance : 5%
First exam: 20%
Pratices: 15%
Assignments: 20%
Second exam: 40%

EXAMINATION RULES.

The exams will be written tests (without notes) and in person
The works will have to be defended in class.
After each practice, a written report will have to be submitted.

BIBLIOGRAPHY

Basic: