Last update: 08-05-2019

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

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering

Teaching unit: 709 - DEE - Department of Electrical Engineering

Academic year: 2019

Degree: MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Andrada Gascon, Pedro

Others: Perat Benavides, Jose Ignacio
Torrent Burgues, Marcel
Blanqué Molina, Balduino

Opening hours

Timetable: To be determined at the start of the course

Prior skills

Basic knowledge of machines and electrical drives.

Learning objectives of the subject

Study load

Total learning time: 125h	Hours large group:	0h	0.00%
	Hours medium group:	0h	0.00%
	Hours small group:	30h	24.00%
	Guided activities:	10h	8.00%
	Self study:	85h	68.00%

Last update: 08-05-2019

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

Content

1.- Electric drives.

Learning time: 8h

Theory classes: 2h
Guided activities: 1h
Self study : 5h

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

Related activities:
Classes of problems in the classroom

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

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

Learning time: 14h

Theory classes: 4h
Guided activities: 2h
Self study : 8h

Description:
2.1. Evaluation of losses. Performance.
2.2. Performance improvement opportunities.
2.3. Variable speed and energy saving.
2.4. Environmental considerations. Life cycle assessment (LCA)
2.5. Methodologies of LCA: MEEUP (Methodology for the Eco-Design of Energy Using Products).
2.6. European Directive (EuP 2005/32/EC).
2.7. Economic considerations (Payback, VAN, TIR).

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

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.

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

3.- Three-phase induction motor drives	Learning time: 14h Theory classes: 6h Guided activities: 7h Self study : 1h

Description:
3.1. Phase induction motors. Analysis of losses.
3.2. Energy efficiency classes.
3.3. Determination of performance. Essays. International Standards (IEC 60034-2, IEEE Std. 112).
3.4. Drives with three-phase induction motors, strategies to improve performance.
3.5. Drives with induction motors, optimal control of energy.

Related activities:
Class of problems in the classroom.

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

4.- Permanent magnet synchronous motor drives	Learning time: 20h Theory classes: 8h Guided activities: 10h Self study : 2h

Description:
4.1. Overview of permanent magnets.
4.2. Synchronous drives with permanent magnets. Classification.
4.3. Synchronous motors of reluctance.
4.4. Continuous current motors, brushless (Brushless D.C. motors)

Related activities:
Class of problems in the classroom.

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

Last update: 08-05-2019

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

5.- Switched reluctance motor drives	Learning time: 14h Theory classes: 4h Guided activities: 2h Self study : 8h

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

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

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

Planning of activities

Assignments	Hours: 45h Self study: 45h

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.

Practices	Hours: 10h Self study: 4h Guided activities: 6h

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.

Last update: 08-05-2019

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

Qualification system

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

Regulations for carrying out activities

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:

Hanselman, Duane C. Brushless permanent magnet motor design. 2nd ed. New York: Magna Physics Pub., 2006. ISBN 9781881855156.

Krishnan, Ramu. Switched reluctance motor drives : modeling, simulation, analysis, design and applications. Boca Raton [etc.]: CRC Press, cop. 2001. ISBN 0849308380.

Boldea, Ion ; S.A. Nasar. Electric drives. 3rd ed. Boca Raton: CRC Press, 2017. ISBN 9781498748209.