Course guide
340610 - GEEN-R3O09 - Energy Management

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering,
710 - EEL - Department of Electronic Engineering.
Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Optional subject).
Academic year: 2022 ECTS Credits: 5.0 Languages: Catalan, Spanish

LECTURER
Coordinating lecturer: Blanqué Molina, Balduino
Others: Castilla Fernandez, Miguel Blanqué Molina, Balduino

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
1. CB6 - Having the knowledge and understanding to provide a basis or opportunity for originality in developing and/or applying ideas, sometimes in a research context
2. CB7 - Students can apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
3. CB9 - Students can communicate their conclusions, knowledge and rationale underpinning these, to skilled and unskilled public in a clear and unambiguous way
4. CC04 - Ability to determine and design the most efficient electric drive for different control applications
5. CG02 - Ability to apply the techniques of control and regulation of electric machines for motion control.
6. CEV06 - Ability to analyze and design power electronic converters used in power generation systems distributor energy.
7. CEV07 - Ability to analyze and design power electronic converters used in micro grids and in smart power networks.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT
The main objective.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>24.00</td>
</tr>
<tr>
<td>Self study</td>
<td>80,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>12.00</td>
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</tbody>
</table>

Total learning time: 125 h
## CONTENTS

1. **Electrical Power Systems Applied to Industry.**

   **Description:**
   Introduction to electrical energy.
   This lesson will introduce the description, modelling and analysis of power systems.

   **Related competencies:**
   CB6. CB6 - Having the knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, sometimes in a research context

   **Full-or-part-time:** 10h 25m
   Theory classes: 3h
   Self study : 7h 25m

2. **Introduction to Energy Management.**

   **Description:**
   Introduction to the management and operation of electric power systems.
   Electrical engineering LV,MV and HV.
   Energy audit (Industry 4.0).

   **Related competencies:**
   CG02. CG02 - Ability to apply the techniques of control and regulation of electric machines for motion control.
   CC04. CC04 - Ability to determine and design the most efficient electric drive for different control applications movement

   **Full-or-part-time:** 10h 25m
   Theory classes: 3h
   Self study : 7h 25m

3. **Integration of electrical machines in power systems.**

   **Description:**

   **Full-or-part-time:** 20h 50m
   Theory classes: 6h
   Self study : 14h 50m
4. Management and control of energy storage systems.

**Description:**
Introduction to management and control of energy storage systems. Batteries (including charging and recharging processes), super-capacitors, flywheels, superconductivity.

**Related competencies:**
- CB9. CB9 - Students can communicate their conclusions, knowledge and rationale underpinning these, to skilled and unskilled public in a clear and unambiguous way
- CB7. CB7 - Students can apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
- CB6. CB6 - Having the knowledge and understanding to provide a basis or opportunity for originality in developing and/or applying ideas, sometimes in a research context

**Full-or-part-time:** 20h 50m
Theory classes: 6h
Self study: 14h 50m

5. Power electronics systems for the integration and energy management in power systems.

**Description:**
Power electronics systems for the integration and energy management in power systems.

**Related competencies:**
- CEV07. CEV07 - Ability to analyze and design power electronic converters used in micro grids and in smart power networks.
- CEV06. CEV06 - Ability to analyze and design power electronic converters used in power generation systems distributor energy.

**Full-or-part-time:** 20h 50m
Theory classes: 6h
Self study: 14h 50m


**Description:**
This lesson will present both the basic concepts in electrical microgrids and some examples of practical microgrids in operation all around the world. This lesson will also discuss the possibilities, properties and limitations of the energy management systems employed in microgrids.

**Related competencies:**
- CEV07. CEV07 - Ability to analyze and design power electronic converters used in micro grids and in smart power networks.

**Full-or-part-time:** 20h 50m
Theory classes: 6h
Self study: 14h 50m

Description:
This lesson will present both the basic concepts of smart grids and some application examples. Besides the energy management strategies used in this kind of advanced power systems will be discussed.

Related competencies:
CB9. CB9 - Students can communicate their conclusions, knowledge and rationale underpinning these, to skilled and unskilled public in a clear and unambiguous way
CB7. CB7 - Students can apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
CEV07. CEV07 - Ability to analyze and design power electronic converters used in micro grids and in smart power networks.

CB6. CB6 - Having the knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, sometimes in a research context

Full-or-part-time: 20h 50m
Theory classes: 6h
Self study: 14h 50m

GRADING SYSTEM

BIBLIOGRAPHY

Basic:

RESOURCES

Audiovisual material:
- Canó, Projector

Computer material:
- Ordinador Personal, 1 per alumne
- Programes Informàtics

Other resources:
MATLAB-Simulink-Simpower.