Course guide
340610 - GEEN-R3O09 - Energy Management

Last modified: 17/05/2023

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: 2023 **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
movement
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

Type	Hours	Percentage
Hours large group	30,0	24.00
Self study	80,0	64.00
Hours small group	15,0	12.00

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:
Electrical machines modelling in power systems. Generation and actuators. Power factor correction. Unbalanced loads and affectation of static converters on the electrical grid.

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

6. Energy management in microgrids.

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 managemt 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

7. Energy management in smart grids.

Description:
This lesson will present both the basic concepts of smartgrids and some application examples. Besides the energy management strategies used in this kind of avanced 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:
- Yazdani, Amirnaser; Iravani, Reza. Voltage-sourced converters in power systems : modeling, control, and applications [on line]. Hoboken, N.J.: Wiley, 2010 [Consultation: 15/02/2024]. Available on: https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9780470551578. ISBN 9780470521564.
- Strzelecki, Ryszard Michal. Power electronics in smart electrical energy networks [on line]. London: Springer, 2008 [Consultation: 14/03/2024]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-1-84800-318-7. ISBN 184800317X.
- Stevenson, William D. Análisis de sistemas eléctricos de potencia. 2a ed. México [etc.]: McGraw-Hill, 1979. ISBN 9686046984.
- Gellings, Clark W. The Smart grid : enabling energy efficiency and demand response [on line]. Lilburn, GA: Fairmont Press, 2009 [Consultation: 14/12/2022]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3239046. ISBN 9781439815748.
- Sturm, Werner. Manual de baja tensión : criterios de selección de aparatos de maniobra e indicaciones para el proyecto de instalaciones y distribución. 2a ed. Munich: Publicis MCD, 2000. ISBN 8426712428.

RESOURCES

Audiovisual material:
- Canó , Projector

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

Other resources:
MATLAB-Simulink-Simpower.