Course guide
280723 - 280723 - Marine Renewable Energies and Energy Optimization

Last modified: 27/05/2025

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: MASTER'S DEGREE IN THE MANAGEMENT AND OPERATION OF MARINE ENERGY FACILITIES (Syllabus 2016). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: VICTOR FUSES NAVARRA

Others: Segon quadrimestre:
VICTOR FUSES NAVARRA - MGOIE

PRIOR SKILLS

Knowledge on electrical and energy systems.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE4-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis de les energies renovables en instal·lacions marines

Transversal:
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Basic:
CB7. That the students can apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their study area.
CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.
CB10. Students must possess the learning skills that enable them continue studying in a way that will be largely self-directed or autonomous.

TEACHING METHODOLOGY

To present and solve mathematical problems with the help (or not) of computers.
During the course, students should develop an individual project to apply the concepts presented in magistral classes. This consists on developing a project on the integration of renewable generating systems and energy storage technologies in a ship. At the end of the course, students should do an oral presentation for the results of the project.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, students:
- Should know the main characteristics of renewable generation and energy storage technologies to be included in ships, as well as the associated management systems.
- Should know and utilize mathematical expressions for the sizing of renewable generating systems and energy storage technologies in ships.
- Should know how to utilize tools for the modeling and simulation of electrical systems, including renewable generation and energy storage technologies in ships.
- Should know how to define a project related to the conceptualization, sizing and utilization of renewable generating systems and energy storage technologies in ships.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	36.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

1. Presentation of the subject. Introduction to the electrical plant for ships with renewable generation and energy storage technologies. Calculation of representative magnitudes.

Description:
Introduction to the subject and review of fundamental concepts for the proper development of the subject.

Specific objectives:
To review fundamental concepts.

Related activities:
Selection of the topic for the project to be developed individually during the course.

Full-or-part-time: 3h
Theory classes: 1h 30m
Guided activities: 0h 30m
Self study : 1h

2. Renewable generation and energy storage technologies.

Description:
Main operating principles, characteristics, technologies that can be found in the market, basic calculations for dimensioning, description of simulation models.

Specific objectives:
To gain knowledge on renewable generation and energy storage technologies.

Related activities:
Analysis of journalistic articles related to marine renewable energies.
Project to be developed individually.
Short practical activities.

Related competencies :
CE4-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis de les energies renovables en instal·lacions marines
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.

Full-or-part-time: 29h 30m
Theory classes: 8h
Guided activities: 3h
Self study : 18h 30m

3. Management systems for renewable generation, energy storage and energy optimization.

Description:
Management and monitoring systems associated to the renewable generation and energy storage technologies are described.

Specific objectives:
To identify management technologies in ships and its importance and functionality.

Related activities:
Project to be developed individually. Short practical activities.

Related competencies :
CB7. That the students can apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their study area.
CB10. Students must possess the learning skills that enable them continue studying in a way that will be largely self-directed or autonomous.

Full-or-part-time: 7h 30m
Theory classes: 4h
Guided activities: 0h 30m
Self study : 3h

4. Renewable energies from the sea with respect to those consumed by the naval sector. World energy and economic context.

Description:
Primary energy sources. Evolution of world energy consumption by typology. Energy sources used for navigation and evolution over time. Types of fuels. Renewable fuels. Impact on pollutant and greenhouse gas emissions. Current situation of renewable energies applicable to navigation and future projection.

Specific objectives:
Know how to quantify the current and future importance of renewable energies for navigation, in relation to the energy needs of the sector.

Related activities:
Analysis of reports on energy consumption of the IMO and other energy-related organizations.

Related competencies :
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.

Full-or-part-time: 5h
Theory classes: 1h
Self study : 4h

GRADING SYSTEM

Final exam = 40%
Short practical activities = 20%
Project = 40%

EXAMINATION RULES.

The usage of calculator is needed for the final exam. Reports for practical activities can be elaborated in groups. The project should be done individually. It is mandatory to assist to the final exam.

BIBLIOGRAPHY

Basic:
- Díaz González, Francisco; Sumper, Andreas; Gomis-Bellmunt, Oriol. Energy storage in power systems [on line]. Chichester: John Wiley & Sons, 2016 [Consultation: 01/09/2022]. Available on: https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781118971291. ISBN 9781118971291.