

Course guide

280819 - 280819 - Ocean Energy Converters

Last modified: 25/10/2023

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

Degree: MASTER'S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: RICARDO BOSCH TOUS

Others: Segon quadrimestre:
RICARDO BOSCH TOUS - MUENO

PRIOR SKILLS

Knowledge of electrical machines, operation and applications.
Knowledge of electrical circuit theory

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

ENO_CEE2-2. Knowledge of the different modes of energy extraction from the sea (specific competence of the specialty in Ocean Energies)

ENO_CEE2-3. Capacity for the design and project of marine energy converters. Knowledge of the methodology for the project of a park of marine energy converters (specific competence of the specialty in Ocean Energies)

Transversal:

CT1. ENTREPRENEURSHIP AND INNOVATION: Knowing and understanding the organization of a company and the sciences that govern the activity; be able to understand the business rules and relationships between planning, industrial and commercial strategies, quality and profit.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Know and understand the complexity of economic and social phenomena typical of the welfare society, being able to relate welfare to globalization and sustainability; acquire skills to use in a balanced manner compatible technology, technology, economics and sustainability.

CT3. TEAMWORK: Ability to work as a member of an interdisciplinary team, either as a member or performing management tasks, with the aim of contributing to projects pragmatically and sense of responsibility, assuming commitments considering the resources available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty, and critically evaluate the results of this management.

CT5. THIRD LANGUAGE Learning a third language, preferably English, with adequate oral and written and in line with the future needs of the graduates.

Basic:

CB6. Possess knowledge and understanding that provide a basis or opportunity be original in the development and / or application of ideas, often in a research context.

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.

CB9. That students can communicate their conclusions and the knowledge and Latest rationale underpinning to specialists and non Specialty clearly and unambiguously.

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

Acquire:

- Criteria for evaluating the technological viability of the various conversion possibilities.
- Specific dimensioning criteria in the different technologies.
- Knowledge for the detailed dimensioning of viable devices.
- Design capacity for devices with criteria of durability and ease of maintenance.

Perform:

- Technological feasibility studies.
- Specific designs of a specific use technology.
- Construction and testing of physical devices, to evaluate technological viability.

LEARNING OBJECTIVES OF THE SUBJECT

Achieve evaluation criteria of the potential and viability of the different technologies.

Achieve development capacity for new devices.

Get the most mature technologies applied to specific facilities.

Know how to build and test the devices in the development phase.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	6,0	4.80
Self study	80,0	64.00
Hours large group	39,0	31.20

Total learning time: 125 h

CONTENTS

Topic 1: Renewable energy available in the ocean

Description:

Resource assessment

- Wave motor
- Tidal
- Currents

Full-or-part-time: 10h

Theory classes: 3h

Guided activities: 4h

Self study : 3h

Topic 2: Methods of transforming wave energy into electrical energy

Description:

- Design principles
- Electromechanical transformation
- Hydraulic and pneumatic use
- Inverse osmosis
- Limits of Operations and profitability
- Analysis of built facilities

Full-or-part-time: 15h

Theory classes: 5h

Guided activities: 6h

Self study : 4h

Topic 3: Methods of transforming tidal energy into electrical energy

Description:

- Design principles
- Types of turbines
- Electricity generators
- Reversibility of water and energy flows
- Estuary pumping philosophies during low elevation differences
- Analysis of built facilities

Full-or-part-time: 16h

Theory classes: 5h

Guided activities: 7h

Self study : 4h

Topic 4: Other systems and elements for obtaining ocean energy

Description:

- Technologies, utilization criteria and design
- Wind
- Currents
- Osmosis
- Analysis of built facilities

Full-or-part-time: 16h

Theory classes: 5h

Guided activities: 7h

Self study : 4h

Topic 5: Organization and production of a park of marine energy converters

Description:

- Project management
- Problems of the resource cycle.
- Auxiliary and internal management services. Photovoltaic generation
- Maintenance and life cycle of the installation

Full-or-part-time: 16h

Theory classes: 5h

Guided activities: 7h

Self study : 4h

Topic 6: Evaluation of risks and costs in the development of systems for obtaining ocean energy

Description:

- Storms and adverse weather risks
- Environmental impact
- Climate change
- Insurance and financial management

Full-or-part-time: 10h

Theory classes: 3h

Guided activities: 3h

Self study : 4h

Topic 7: Storage or use of generated energy

Description:

- Chemical batteries
- Kinetic electrical energy accumulators
- Pumping

Full-or-part-time: 10h

Theory classes: 3h

Guided activities: 3h

Self study : 4h

Topic 8: Integration of power generation systems with other offshore platforms

Description:

- Static electrical energy converters
- High voltage DC links, DC-AC and AC-DC converters
- Control and protection of electrical systems

Full-or-part-time: 16h

Theory classes: 5h

Guided activities: 7h

Self study : 4h

Topic 9: R + D + i in the field of ocean energy

Description:

- Use of current afloat, anchored or moored
- Importance of ocean sailing competitions
- Hydrogenerators in sports boats, use of wave power and particle rotation.
- Use of water-air interfaces in energy use
- National, European and international policies in R + D + i
- Analysis of facilities built
- Electricity rates in Spain
- Lines of action and preferences

Full-or-part-time: 16h

Theory classes: 5h

Guided activities: 7h

Self study : 4h

GRADING SYSTEM

The final grade is the sum of the following partial grades:

$$N_{\text{final}} = 0.2 N_{\text{pf}} + 0.6 N_{\text{pt}} + 0.2 N_{\text{ec}}$$

N_{final}: Final qualification

N_{pf}: Final test qualification

N_{pt}: Qualification of works (two)

N_{ec}: Qualification of the course exercises (continuous assessment)

EXAMINATION RULES.

It is mandatory to attend the evaluation activities and participate in the classes, activities and visits that take place during the course, will determine the continuous evaluation mark

BIBLIOGRAPHY

Basic:

- Carta González, José Antonio, [et al.]. Centrales de energías renovables : generación eléctrica con energías renovables [on line]. 2a ed. Madrid: Pearson, 2013 [Consultation: 30/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1324. ISBN 9788483229989.

Complementary:

- López Mendizabal, Ramón [et al.]. Con el viento a favor = With a fair wind. [Madrid]: Fundación ESTEYCO, 2015. ISBN 9788494332425.