



Course guide

280806 - 280806 - Analysis and Design of Ship and Ocean Structures

Last modified: 27/05/2025

Unit in charge: Barcelona School of Nautical Studies

Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering.

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

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

LECTURER

Coordinating lecturer: JAVIER MARTINEZ GARCIA

Others: Segon quadrimestre:
JAVIER MARTINEZ GARCIA - MUENO

PRIOR SKILLS

Bachelor in System Engineering and Naval Technology
Bachelor in Naval Architecture

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

MUENO_CE1. Ability to design ships suitable for the needs of the maritime transport of people and goods, and those of maritime defense and security

MUENO_CE3. Knowledge of the dynamics of the ship and of the naval structures, and ability to perform optimization analysis of the structure, the integration of the systems on board, and the behavior of the ship at sea and its maneuverability

MUENO_CE7. Ability to project ocean platforms and artifacts

MUENO_CE16. Ability to develop and manage logistics support engineering, maintenance and repair of ships and artifacts

General:

MUENO(CG2). Ability to conceive and develop solutions that are technically, economically and environmentally appropriate to the needs of maritime or integral transportation of people and goods, of the use of oceanic resources and of the marine subsoil (fishing, energy, minerals, etc.), adequate use of the marine habitat and means of defense and maritime security)

MUENO(CG3). Ability to project ships and boats of all kinds

MUENO(CG5). Ability to design and control the construction, repair, transformation, maintenance and inspection processes of previous mills

MUENO(CG6). Ability to conduct research, development and innovation in naval and ocean products, processes and methods

MUENO(CG8). Ability to analyze and interpret measurements, calculations, evaluations, appraisals, studies, reports, work plans and other similar works

MUENO(CG15). Ability to organize and direct multidisciplinary work groups in a multilingual environment, and to generate reports for the transmission of knowledge and results



Transversal:

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

Master Class

Class with students participation

Cooperative learning

Self learning by solving problems and exercises

Learning based on projects

LEARNING OBJECTIVES OF THE SUBJECT

Capacity to design and develop the project of a ship or a marine structure, according to given requirements.

Capacity to solve correctly problems related to marine and ship engineering based on serviceability needs as well as fulfilling safety, environmental and economic requirements.

Capacity to apply basic and advanced concepts regarding marine and ship engineering to the solution of problems of marine and ship engineering.

Knowledge of the structural strength mechanisms and their application for designing ships and offshore platforms. Knowledge of the most common failure mechanisms and the means to prevent them. Capacity to design safe structures complying with standards.

Capacity to solve complex mathematical problems and their application to the solution of engineering problems. Knowledge of the numerical tools available to solve these problems.

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. Introduction to ship design and marine structures

Description:

Design procedure of the ship and marine structures.
Limit state analysis.
Relation between limit state analysis and strength of materials theory.
Numerical analysis methods.

Full-or-part-time: 6h

Theory classes: 3h
Self study : 3h

2. Structural elements analysis and design

Description:

Normal and tangential stresses in beam elements.
Lateral buckling of beams.
Buckling of panels.
Analysis of bolted connections.
Analysis of welded connections.

Full-or-part-time: 34h

Theory classes: 8h
Practical classes: 8h
Self study : 18h

3. Loads in ships and marine structures

Description:

Loads in ships.
Loads in marine structures.
Load combination.

Full-or-part-time: 18h

Theory classes: 6h
Guided activities: 4h
Self study : 8h

4. Longitudinal strength of hull girder

Description:

Longitudinal strength of hull girder.
Ship cross sections.
Longitudinal stresses in the ship.
Torsional effects on the hull.
Elements distribution and stress concentrations.

Full-or-part-time: 20h

Theory classes: 4h
Practical classes: 4h
Self study : 12h



5. Transverse strength of the ship

Description:

Transverse strength of the ship.
Design and analysis of structural elements.

Full-or-part-time: 15h

Theory classes: 2h
Practical classes: 2h
Self study : 11h

6. Analysis structural elements in the ship

Description:

Design of structural elements in the ship.
Structural particularities of the different structural elements of the ship.

Full-or-part-time: 16h

Theory classes: 2h
Guided activities: 4h
Self study : 10h

7. Dynamic analysis of marine structures

Description:

Theoretical background behind the modal analysis of structures.
Modal analysis of structures.
Hull structure vibrations.

Full-or-part-time: 16h

Theory classes: 4h
Practical classes: 2h
Self study : 10h

GRADING SYSTEM

The final mark of the course will be obtained with the following formula:

$$N_{final} = 0.3 \cdot N_{pp} + 0.7 \cdot N_{ec}$$

N_{final} : Final Mark

N_{pp} : Mark obtained in a mid-term test

N_{ec} : Mark obtained from course projects and assignments

EXAMINATION RULES.

The student must complete at least the 75% of the course exercises and assignments to be evaluated of the course.
The student can have notes with equations, maximum five pages, in the course tests.



BIBLIOGRAPHY

Basic:

- Bai, Yong; Jin, Wei-Liang. Marine structural design [on line]. 2nd ed. Oxford: Butterworth-Heinemann, 2016 [Consultation: 01/09/2022]. Available on: <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780080999975/marine-structural-design>. ISBN 9780080999975.
- Eyres, David J. Ship construction [on line]. 6th ed. Oxford: Butterworth-Heinemann, 2007 [Consultation: 01/09/2022]. Available on: <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780750680707/ship-construction>. ISBN 9780750680707.
- Instrucción de Acero Estructural (EAE) [on line]. España: Ministerio de Fomento, 2011 [Consultation: 07/11/2019]. Available on: https://www.fomento.gob.es/MFOM/LANG_CASTELLANO/ORGANOS_COLEGIADOS/MASORGANOS/CPA/INSTRUCCIONES/VERSION_CASTELLANO/.
- Okumoto, Yasuhisa (ed.). Design of ship hull structures : a practical guide for engineers [on line]. Berlin: Springer Berlin Heidelberg, 2009 [Consultation: 28/07/2017]. Available on: <http://dx.doi.org/10.1007/978-3-540-88445-3>. ISBN 9783540884446.