Course guide
280671 - 280671 - Materials in the Naval Industry

Last modified: 09/05/2023

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering.

Degree: BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 7.5 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: SERGIO IVÁN VELASQUEZ CORREA

Others: Segon quadrimestre:
SERGIO IVÁN VELASQUEZ CORREA - DT, GESTN

PRIOR SKILLS

Knowledge and skills in: science and materials engineering, chemistry, physics, thermodynamics and thermotechnics
Skills acquired in design and structural analysis of marine systems

REQUIREMENTS

Physics
Chemistry
Mechanics, Resistance and Technology of materials
Projects on Naval Technology and Systems

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge of science and technology of materials and capacity for selection and evaluation of their behavior
2. Knowledge of materials for machinery, equipment and naval systems and criteria for selection.

TEACHING METHODOLOGY

Receive, understand and synthesize knowledge.
Raise and solve problems.
Develop the reasoning and critical spirit and defend it in an oral or written way.
Do a group job.
Properly select materials oriented to the production of products within the naval field applying methodologies of optimal selection of materials

LEARNING OBJECTIVES OF THE SUBJECT

- To know the different construction materials used in the shipbuilding industry and its characteristics. Emphasis will be placed on the maintenance and prevention of corrosive processes.
- To apply the knowledge acquired on the assembly and maintenance of marine propellants.
- To apply the criteria for optimum selection of materials in the different sections of the ship or naval system, considering structural aspects, performance, recyclability and durability. Concepts of product life cycle and circular economy will be exposed
- To study with books and articles in English.

STUDY LOAD

Type	Hours	Percentage
Self study	112,5	60.00
Hours medium group	23,3	12.43
Hours large group	45,0	24.00
Guided activities	6,7	3.57

Total learning time: 187.5 h

CONTENTS

(ENG) Iron alloys and stainless steels

Description:
Manufacture of steel. Thermal treatments. Steel boat sections. Shipbuilding steel. High tension steel. Corrosion resistant steel. Sandwiche or steel panels. Mechanical treatments.

Specific objectives:
To determine the behaviour of different ferrous alloys when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine.
To determine the corrosion resistance of the ferrous alloys, the methods to improve their behaviour in marine environments
To select optimal alloys following the classification societies rules

Related activities:
To solve problems of materials and their application to the behaviour of real solids in structures, marine facilities and equipment.
To Use of material selection techniques, analytical processes and guided by material selection software
Group work to select materials according to their application in specific sections of the ship and other naval or marine systems

Full-or-part-time: 15h
Theory classes: 5h
Guided activities: 5h
Self study : 5h

(ENG) Aleaciones de Aluminio.

Description:
Production of Aluminum. Sandwich or aluminium panels. Protection against fire.

Specific objectives:
To define the behaviour of different aluminium alloys when they are subjected to tension and obtain the following tensile properties of the materials of the universal test machine.
To define the corrosion resistance of aluminium alloys and methods to improve their performance in marine environments
To Select optimal aluminium alloys following the rules of the classification societies in different parts of the ship, hull, covers, parts of machines, etc.

Related activities:
To solve problems of materials and their application to the behaviour of real solids in structures, marine facilities and equipment.
To Use of material selection techniques, analytical processes and guided by material selection software
Group work to select materials according to their application in specific sections of the ship and other naval or marine systems

Full-or-part-time: 10h
Theory classes: 4h
Guided activities: 1h
Self study : 5h

(ENG) Sociedades de Clasificación.

Description:
Regulation and regulation. Lloyds Register. Structural design programs. Inspections Repair of damages. Paint and coatings Dry dock. Planned maintenance of the helmet. Tests for hull materials by the classification societies.

Specific objectives:
To apply the different regulations defined by the classification societies, the IACS and the IMO related to the design and selection of materials used in the marine sector and marine systems
To understand the functioning of the different organisms and maritime safety schemes in the construction of vessels, their inspection and registration, classification and maintenance of the class, port state control and memoranda of understanding
To understand the principles governing ship inspections and their management through the EQUASIS databases and other sub-standard vessel listing systems

Related activities:
Analysis of class certifications
Analysis of statutory certifications
Analysis of checklists prior to a class or port state inspection
Study of tests on naval materials

Full-or-part-time: 11h 20m
Theory classes: 3h 20m
Self study : 8h

(ENG) Resistencia de Materiales.

Description:
Stress, Fracture. Fatigue. Buckling. Monitoring of efforts at sea.

Specific objectives:
To determine the behaviour of different materials when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine:
(i) UTS, (ii) Yield Stress, (iii) Young’s Modulus, (iv) Breaking Stress, (v) Percentage Elongation, (vi) Percentage reduction in area and (vi) Plotting of Curve of –Stress vs Strain.

Related activities:
Resolution of problems about mechanical properties of materials
Analysis of different deformation stress curves
Identification of the different limits of materials subjected to stress

Full-or-part-time: 19h
Theory classes: 8h
Guided activities: 5h
Self study : 6h

Composite materials and other types of materials

Description:
Properties and uses of these materials in specific applications within the naval systems

Specific objectives:
Have a wide range of materials in order to choose the best materials that allow them to design and manufacture useful products in different sections of the ship, naval system or propulsion
Apply optimal selection techniques through selection matrices, classification societies standards and specific selection software. The use of CES Edupack software is recommended

Related activities:
Exercises and problems applied
Selection in CES edupack software
Selection of materials for the work of the subject

Full-or-part-time: 15h
Theory classes: 10h
Guided activities: 5h

ACTIVITIES

name english

Description:
Use of CES Edupack software for learning material selection. Various activities will be carried out to select materials in different sections of the ship through this program.

Specific objectives:
To acquire skills and abilities in the use of intelligent materials selection tools, optimizing time and improving decision-making in naval design processes

Material:
GRANTA EduPack is a set of teaching resources that support materials education across engineering, design, science and sustainable development.

GRANTA EduPack provides:

A comprehensive database of materials and process information
Powerful materials software tools
A range of supporting resources: e.g. lectures, projects and exercises

Delivery:
Individual application project

Full-or-part-time: 20h
Guided activities: 10h
Self study: 10h

GRADING SYSTEM

Nfinal = 0.5 Npf + 0.5 Nac

Nfinal: final and global grade
Npf: final exam grade
Nac: continuous evaluation grade

The final test consists of a written exam where all the concepts and elements dealt with in the subject will be evaluated, both on a practical and theoretical level.
The continuous assessment note consists of 30% of the grade of a group work. It is a necessary condition to pass the course to submit and have approved with a minimum grade of 6.0 the work. The remaining 20% of the grade corresponds to a partial exam.

EXAMINATION RULES.

Students must submit the work of the subject and obtain a minimum grade of 6.0. In case of not exceeding this minimum grade, the subject is considered suspended.
All the works and tests of continuous evaluation delivered after the deadline or form will be considered as NOT delivered and will not be qualified.
In the final exam you can only have a calculator, pen and the notes and / or material authorized by the teacher.

BIBLIOGRAPHY

Basic:
- 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.
- Ashby, Michael; Shercliff, Hugh; Cebon, David. Materials : engineering, science, processing and design. 3rd ed. Oxford: Butterworth-Heinemann, 2014. ISBN 9780080977737.
- Budinski, Kenneth G.; Budinski, Michael K. Engineering materials : properties and selection. 9th ed. Upper Saddle River: Prentice Hall, 2010. ISBN 9780137128426.

Complementary:
- Van Dokkum, Klaas. Ship knowledge. 9th ed. Enkhuizen: DOKMAR, 2016. ISBN 9789071500329.

RESOURCES

Other resources:
CES EduPack 2019
CES EduPack is the world-leading teaching resource for materials in engineering, science, processing, and design.