

## Course guide

### 280667 - 280667 - Propulsion

Last modified: 09/10/2023

**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

#### LECTURER

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**Coordinating lecturer:** JOEL JURADO GRANADOS

**Others:** Primer quadrimestre:  
JOEL JURADO GRANADOS - DT, GESTN, MUENO  
ARNAU LLOANSÍ COLOM - DT, GESTN, MUENO

#### REQUIREMENTS

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It is advisable to have previously taken the subject 280645-Fluid Mechanics

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. Knowledge of methods of design of naval propulsion systems.

#### TEACHING METHODOLOGY

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Lectures and resolution of problems. Exercises proposed by the teacher. Individual and team works. Tutorials.

#### LEARNING OBJECTIVES OF THE SUBJECT

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Learn the procedures to select a marine propeller.

Understand the different propulsive systems nowadays and their needs. Then student must be able to apply the knowledge learned to assemble and maintenance of marine propellers and their propulsive system. Discern the different propulsive solutions.

Make basic calculus of propeller design. Understand the cavitation phenomenon, problems involved and solutions to make. The student should be able to choose a main engine according to the needs and requirements of the vessel.

#### STUDY LOAD

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

**Total learning time:** 187.5 h



## CONTENTS

### Lesson 1: Introduction to hydrodynamics. Components of the drag resistance

**Description:**

Components of the drag resistance. Froude's theory.

Viscous drag resistance: flat plane, frictional lines, form factor, viscous pressure drag, boundary layer separation, form influences, rugosity.

Wave making drag resistance: wave system related to the ship, limited depth, lateral restriction, wave pattern.

Other components: appendages drag resistance, aerodynamic drag resistance.

**Full-or-part-time:** 15h

Theory classes: 15h

### Lesson 2: Tests with models. Vessel design

**Description:**

Tests with models: towing tanks, scale effects, correlation methods.

Vessel design: systematic series, influences of the shape, non-conventional vessels.

Methods used nowadays to design ships.

**Full-or-part-time:** 15h

Theory classes: 15h

### Lesson 3: Introduction to propellers. Fundamentals of propellers.

**Description:**

Introduction: Elements of the propulsion machinery. Geometry of the propeller.

Fundamentals: Momentum theory, circulation theory, blade element theory.

**Full-or-part-time:** 15h

Theory classes: 15h

### Lesson 4: Tests with propellers. Study of the cavitation.

**Description:**

Open-water tests: fulfilment of test, purpose of the test.

Autopropulsive test: Fulfilment of the test, purpose of the test, propeller-hull interaction, study of the wake.

Cavitation: Phenomenon, reasons and ways to appear, effects to the propeller, prevention.

**Full-or-part-time:** 15h

Theory classes: 15h

### Lesson 5: Propeller projects. Choosing the main engine

**Description:**

Systematic series, optimal diameter, optimum speed.

Different types of propellers: controllable pitch propellers, waterjet, vertical axis, cavitation propellers, pods.

**Full-or-part-time:** 15h

Theory classes: 15h

## GRADING SYSTEM

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### CONTINUOUS EVALUATION

$$N_{\text{course}} = 0.40 * P1 + 0.40 * P2 + 0.20 * Nt$$

Nt: marks of assignments done in groups and individually.

P1: first test. Hydrodynamics and drag resistance lectures will be evaluated.

P2: second test. Propeller lectures will be evaluated. This test will be done the last day of the course.

Final test: Those students that want improve their marks in any part of the P1 and P2 can do the final exam. The mark in those parts evaluated in the final exam, will be the final mark for each part.

### REEVALUTATION:

The reevaluation will be a written exam that comprises all the concepts seen during the course.

## EXAMINATION RULES.

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The tests during the course are divided into theoretical concepts and exercises.

The final exam of January makes average with the marks of the assignments. In the reevaluation exam, the assignment mark does not count for the final qualification.

## BIBLIOGRAPHY

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### Basic:

- Carlton, J. S (John S.). Marine propellers and propulsion [on line]. 4th ed. Oxford: Butterworth-Heinemann, 2019 [Consultation: 13/11/2023]. Available on: <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780081003664/marine-propellers-and-propulsion?via=ihub=>. ISBN 9780081003664.
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- Principles of naval architecture. vol. 2, Resistance, propulsion and vibration. 2nd revision. Jersey City, NJ: The Society of Naval Architects and Marine Engineers, 1988-1989. ISBN 0939773015.
- Baquero, Antonio. Resistencia y propulsión del buque : hidrodinámica del buque I. Madrid: ETSIN, 2015.