Course guide
280619 - 280619 - Ship Theory and Naval Construction

Last modified: 12/09/2022

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

Degree: BACHELOR'S DEGREE IN NAUTICAL SCIENCE AND MARITIME TRANSPORT (Syllabus 2010). (Compulsory subject).

Academic year: 2022 **ECTS Credits:** 9.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: MARCEL·LA CASTELLS SANABRA

Others: MARCEL·LA CASTELLS SANABRA
JORGE MONCUNILL MARIMON

REQUIREMENTS

Having passed the course of "Ship Stability" Q4 Grade Nautical and Maritime Transport or this subject should be in compensated conditions at the end of the cycle.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. In-depth knowledge of the theory of ship. Buoyancy. Static and dynamic stability, transverse and longitudinal. Effects of movement and weight distribution. Hydrostatics and hydrodynamics. Resistance and propulsion. Subdivision flooding and stranding. Extensive knowledge of the dynamics of marine vehicles.

Transversal:
CT6. GENDER PERSPECTIVE: An awareness and understanding of sexual and gender inequalities in society in relation to the field of the degree, and the incorporation of different needs and preferences due to sex and gender when designing solutions and solving problems.

TEACHING METHODOLOGY

- Receive, understand and synthesize knowledge.
- Solve problems, providing, if it's possible, solutions with social relevance.
- Develop the reasoning and critical thinking, and be able to transform one's own thinking in new directions based on the incorporation of the experiences of colleagues.
- Work both independently and in a group, giving to all students voice in the classroom.
- Learining based in LCHS 5000 Large Crude Oil Carrier (LCC) Tanker Simulator.

The resolution of problems should lead to contextualised solutions with social relevance. In this way, the discipline is humanised and future professionals are trained with a gender and inclusive perspective that is more useful for society. In addition, the promotion of collaborative methodologies in the classroom not only favours the incorporation of students' experiences as learning materials but also empowers them and makes them jointly responsible for their own learning process. In addition, the incorporation critical thinking helps them steer their thinking in new directions.

LEARNING OBJECTIVES OF THE SUBJECT

Students should be able to identify and understand different needs due to sex, gender and other types of diversity within the area of the discipline.

- Know the issues of flooding and grounding
- Understand the effects of movement as well the dynamics of marine vehicles.
- Know the properties and structural elements of a ship.
- Know the hydrodynamic resistance, the types of marine propulsion and the materials used in shipbuilding.
- To be able to calculate the longitudinal strength to which the structure of a ship is subjected.
- Know, understand and respect, from the own degree's field, gender, social, cultural and economic diversity.

On the other hand, one of the objectives of this subject is provide the knowledge, understanding and proficiency of the competency "Respond to emergencies" of Table A-II/1-5 and the competency "Respond to navigational emergencies" of Table A-II/2-9 and "Control Trim, stability and Stress" of Table A-II/2-15 of the Seafarers, Training, Certification and Watchkeeping (STCW) International Code.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	20.00
Hours medium group	45,0	20.00
Self study	135,0	60.00

Total learning time: 225 h

CONTENTS

Chapter 1. Distribution of cargo between two holds

Description:
In this chapter the distribution of cargo between two or more holds will be studied.

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Chapter 2. Relationship between the type of ship and her stability

Description:
Buoyancy and Static Stability. Transversal and longitudinal Dynamics. Knowledge of IMO recommendations concerning ship stability (A-II/2-15.3) and explore the characteristics of stability according to the type of vessel: tankers, fishing vessels, icebreakers, high speed crafts, among others. Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability (this knowledge is necessary in accordance with STCW Code Table A-II/2-15.1)

Full-or-part-time: 30h
Theory classes: 12h
Self study : 18h

Chapter 3. Bulk grain loading

Description:
- Background Information concerning bulk grain
- Calculations of volumetric heeling moments
- Stability regulations for loading bulk grain

Full-or-part-time: 20h
Theory classes: 8h
Self study : 12h

Chapter 4. Optimum trim

Description:
Study of the optimum trim of the vessel for fuel consumption efficiency.

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Chapter 5. Stabilizer systems and Ship Dynamics

Description:
- Description of the classification and functionality of the different stabilizer systems.
- Ship Dynamics

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Chapter 6. Grounding

Description:
- Overview. Initial action to be taken following a collision or a grounding; initial damage assessment and control (Table A-II/1-5.2 STCW code)
- Calculate the reaction
- Effect of grounding on the drafts, transverse stability and heel
- Precautions when beaching a ship (Table A-II/2-9.1 STCW code)
- Action to be taken if grounding is imminent, and after grounding (Table A-II/2-9.2 STCW code)
- Refloating a grounded ship with and without assistance (Table A-II/2-9.3 STCW code)
- Drydocking

Full-or-part-time: 35h
Theory classes: 14h
Self study : 21h

Chapter 7. Flooding and damage compartments

Description:
- Types of flooding.
- Methods of calculation of the flood.
- Effects of flooding on the drafts, list and stability.
- Action to be taken if collision is imminent and following a collision or impairment of hte watertight integrity of the hull by any cause (Table A-II/2-9.4 Code STCW)
- Knowledge of the effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and counter measures to be taken (Table A-II/2-15.2 Code STCW).

Full-or-part-time: 35h
Theory classes: 14h
Self study : 21h

Chapter 8. Properties and structural elements of a ship

Description:
- Description and comprehension of the properties that a ship must have.
- Knowledge of the structure, parts and elements of ships.

Full-or-part-time: 30h
Theory classes: 12h
Self study : 18h

Chapter 9. Ship Resistance and Propulsion

Description:
- Basic Notions of hydrodinamic resistance and propulsion.
- Types of propulsion.

Full-or-part-time: 15h
Theory classes: 6h
Self study : 9h

Chapter 10. Materials used in naval construction and their protection

Description:
- Notions of the types of materials used in shipbuilding and their characteristics.
- Maintenance.

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

Chpater 11. Longitudinal strength and vibrations

Description:
- Incidence of the cargo distribution and the waves in the longitudinal strength of a ship.
- Determination of the load curves, shear forces and bending moments.

Full-or-part-time: 20h
Theory classes: 8h
Self study : 12h

ACTIVITIES

Loading Control System (LCS) module of Tanker simulator practices.

Description:
The main objective of these practices is that the student integrates the skills acquired in his/her studies in Ship stability and Naval Construction in a totally practical way by means of the use of Loading Control System (LCS) module of the tanker Simulator (competences A-II/1-10.1, A-II/1-13.1, A-II/1-13.1.3, A-II/1-13.2, A-II/2-9.4, A-II/2-15.1, A-II/2-15.2 i A-II/2-15.3).

Practice 1. Getting acquainted with the Loading Control System (LCS) module of the tanker simulation. During the practice the structure of the Simulator and different commands will be explained; how to access local panels, system diagrams and the control and monitoring system.

Practice 2. Comparative analysis of different cargo situations considering intact and damage stability as well longitudinal strengths. Following scenarios will be analysed: ballast, cargo, sagging and hogging conditions.

Practice 3. Ballast tanks operations. How to activate different elements (valves, pumps, etc.) and the legend of their state in the system. At the end of this practice, a practical exercise associated to the course learning objectives, concerning knowledge or comprehension will be carried out (individual or cooperative).

Specific objectives:
- Generate learning experiences by reproducing situations as likely as possible.
- Promote teamwork and collaboration among equals as an effective strategy for solving problems.
- Assess the different actions regarding decision-making and risk situations.

Delivery:
The score obtained in these practices will be the 20% of continuous assessment of Ship Stability part.

Related competencies :
CE23.GEN. In-depth knowledge of the theory of ship. Buoyancy. Static and dynamic stability, transverse and longitudinal. Effects of movement and weight distribution. Hydrostatics and hydrodynamics. Resistance and propulsion. Subdivision flooding and stranding. Extensive knowledge of the dynamics of marine vehicles.
CT6. GENDER PERSPECTIVE: An awareness and understanding of sexual and gender inequalities in society in relation to the field of the degree, and the incorporation of different needs and preferences due to sex and gender when designing solutions and solving problems.

Full-or-part-time: 15h
Laboratory classes: 6h
Self study: 9h

Simulators are used to generate learning experiences by reproducing situations that are as realistic as possible, in a safe learning environment. The scenarios, specifically designed and created for the simulation, enable students to take decisions they consider relevant in a given situation, by applying different specific and cross-disciplinary competences. A more gender-sensitive methodology can be applied once the activity has been completed, by providing space for students to share their learning, reflect on their experience and propose alternative actions. Students can also assess their actions regarding various possibilities of leadership, decision-making and risk situations which allow potential differences between male and female student performance.

GRADING SYSTEM

The final score is the sum of the following p
Nfinal = 0.67Nss + 0.33Nc

Nfinal: final score; Nss: final score ship stal

From both parts, there will be some partial exams during the course and continuous assessment.
Nss = 40% final exam + 40% partial exam + 20% continous assessment; a minimum score of 4 for the partial exam is required. Otherwise, all the themes will be included in the final exam.

Nc = Partial exam note (topics 8 and 9) * 50 % + Final exam note (topics 10 y 11) * 50 %; a minimum score of 4 for the partial exam is required. Otherwise, all the themes will be included in the final exam.

The act of re-evaluation will be done through a final exam where all the course material will be assessed.

EXAMINATION RULES.

- You can't pass the course if all work activities and continuous assessment are carried out and submitted.
- If the student does not carried out partial and/or final exam, he or she will be considered as: Not Presented
- In any case, the student can use any kind of predesigned form in controls or tests.

BIBLIOGRAPHY

The bibliography should include the full names of the authors, not just the initials, to increase the visibility of women's contribution to scientific knowledge.

Basic:

- Olivella Puig, Joan. Teoría del buque : estabilidad, varada e inundación [on line]. Barcelona: Edicions UPC, 1996 [Consultation: 14/03/2016]. Available on: http://hdl.handle.net/2099.3/36375. ISBN 8483011557.
- Olivella Puig, Joan. Teoría del buque : ola trocoidal, movimientos y esfuerzos [on line]. Barcelona: Edicions UPC, 1998 [Consultation: 12/06/2014]. Available on: http://hdl.handle.net/2099.3/36646. ISBN 8483012596.
- Olivella Puig, Joan. Teoría del buque : flotabilidad y estabilidad [on line]. 2a ed. Barcelona: Edicions UPC, 1995 [Consultation: 16/06/2012]. Available on: http://hdl.handle.net/2099.3/36216. ISBN 848314750.
- Rawson, Kenneth John; Tupper, Eric Charles. Basic ship theory [on line]. 5a ed. Boston: Butterworth-Heinemann, 2001 [Consultation: 30/05/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780750653985/basic-ship-theory. ISBN 280619.
- Muckle, William. Naval architecture for marine engineers. London: Newnes-Butterworths, 1975. ISBN 0408001690.

Complementary:

- Derrett, Daniel Raymond; Barrass, Bryan. Ship stability for masters and mates. 7th ed. Amsterdam: Elsevier, 2013. ISBN 9780080970936.
- Pursey, Henry James. Merchant ship construction: especially written for the merchant navy. 7a ed. Glasgow: Brown, Son & Ferguson, 1983. ISBN 0851744540.
- White, Geoffrey William. Elementary beam theory and the ship girder. London: Stanford Maritime, 1979. ISBN 0540073520.

RESOURCES

Other resources:

LCHS 5000 Large Crude Oil Carrier (LCC) Tanker Simulator, Wärtsilä