Course guide
280644 - 280644 - Ship Theory

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

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

Academic year: 2023   **ECTS Credits:** 6.0   **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	ANTONI IGNACI LLULL MARROIG
Others:	Segon quadrimestre:
	ANTONI IGNACI LLULL MARROIG - DT, GESTN
	ANTONI MORRAL OYAMBURU - GTM

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
GTM.CE14. Knowledge, use and application of the ship from the principles of the theory of the ship.
GESTN.CE7. Knowledge of the fundamental concepts of fluid mechanics and its application to the hulls of ships and artifacts, and machines, equipment and naval systems.

STCW:
ME.1. A-III/1-4. Function: Controlling the operation of the ship and care for persons on board at the operational level
ME.2. A-III/1-4.2 Maintain seaworthiness of the ship
ME.3. A-III/1-KUP 4.2.1.1 Ship stability: Working knowledge and application of stability, trim and stress tables, diagrams and stresscalculating equipment
ME.4. A-III/1-KUP 4.2.1.2 Ship stability: Understanding of the fundamentals of watertight integrity
ME.5. A-III/1-KUP 4.2.1.3 Ship stability: Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy

TEACHING METHODOLOGY

- Recieve, understand and synthesize knowledge.
- Solve problems.
- Develop the reasoning and critical Thinking.
- Incorporate the gender perspective.

LEARNING OBJECTIVES OF THE SUBJECT

The student, once the course is finished, will be able to demonstrate that:
· Knows, uses and applies the principles of ship theory.
· It is capable of solving any type of problem associated with the theory of the ship on board.
· Find a practical and real relationship of the matter in the job entrusted to him on board ships.
· Identify, model and pose problems from open situations. Explore and apply the alternatives for its resolution.

This course is included in the first UPC Gender and Teaching Project whose main aim is to incorporate the gender perspective in diferent degree courses.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	45,0	30.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

Chapter 1. Definitions

Description:
Ship characteristics. Reference lines. Laws of flotation. Buoyance. Displacement. Tonnage. General dimensions. Drafts. Form coefficients. Situation of a point in the ship. Hydrostatic Curves.

Full-or-part-time: 16h
Theory classes: 6h
Self study : 10h

Chapter 2. Approximate methods to calculate buoyancy and stability.

Description:
Calculation of areas, moments, centers of gravity, inertia and volumes. Method of trapezoids and the Simpson's first rule.

Full-or-part-time: 26h
Practical classes: 6h
Guided activities: 10h
Self study : 10h

Chapter 3. Tonnage and maximum load lines.

Description:
Definition of tonnage. Moorsom system. IMO system. Shelter-Deck Ship. Maximum load lines. Zones and seasonal periods. Maximum permissible drafts.

Full-or-part-time: 13h
Theory classes: 2h
Practical classes: 1h
Self study : 10h

Chapter 4. Drafts

Description:
Laws of flotation. Trim correction. Trim. Calculation of fore and aft trim. Calculation of fore and aft alteration. TPC and displacement curves. Effect of change of density on draft and trim. River problems.

Full-or-part-time: 14h
Theory classes: 2h
Practical classes: 2h
Self study : 10h

Chapter 5. Centre of Gravity

Description:
Weight movements. Using moments to find the center of gravity. TPC

Full-or-part-time: 14h
Theory classes: 2h
Practical classes: 2h
Self study : 10h

Chapter 6. Center of Buoyancy

Description:
Isocarenas and isoclines, definition. Properties of the center of buoyancy. Properties of the submerged volume curve.

Full-or-part-time: 14h
Theory classes: 2h
Practical classes: 2h
Self study : 10h

Chapter 7. Initial stability

Description:
Stability classification. Transverse metacenter, Metacentre height and transverse metacentric radius. Metacentric evolute. Longitudinal Metacentre and longitudinal metacentric radius. Initial stability. Calculation of heel. The inclining experiment. Initial longitudinal static stability.

Full-or-part-time: 18h
Theory classes: 6h
Practical classes: 2h
Self study : 10h

Chapter 8. Stability at large angles of inclination

Description:
ATWOOD formula. KN Curves. Free surfaces. Stability curves. Analyzing a statical stability curve.
Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment.
Understanding of the fundamentals of watertight integrity.
Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy.

Related competencies :
A31-4.2.1c. A-III/1-KUP 4.2.1.3 Ship stability: Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy
A31-4.2.1b. A-III/1-KUP 4.2.1.2 Ship stability: Understanding of the fundamentals of watertight integrity
A31-4.2.1a. A-III/1-KUP 4.2.1.1 Ship stability: Working knowledge and application of stability, trim and stress tables, diagrams and stresscalculating equipment

Full-or-part-time: 22h
Theory classes: 6h
Practical classes: 6h
Self study : 10h

Chapter 9. Dynamical stability

Description:
Definition and calculation. Stability criteria.

Full-or-part-time: 13h
Theory classes: 1h
Practical classes: 2h
Self study : 10h

GRADING SYSTEM

The final score is the sum of the followin partial grades:
Nfinal = 0,6 Np + 0,4 Nac
Nfinal: final grade
Np: grading of the partial and final tests
Nac: continuous assessment (additional activities, practices and attendance)

The partial and final tests consist of a part with questions on concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises. Continuous assessment consists of different activities, both individual and group, of a cumulative and formative nature, carried out throughout the course.

Criteria for evaluating STCW A-III/1: The stability conditions comply with the IMO intact stability criteria under all conditions of loading. Actions to ensure and maintain the watertight integrity of the ship are in accordance with accepted practice.

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.
The exams average must be as minimum 5, to compute the final mark of the subject.

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

Basic:
- Rawson, K. J.; Tupper, E. C. Basic Ship Theory [on line]. 5th 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 9780750653967.
- Olivella Puig, Joan. Teoría del buque : flotabilidad y estabilidad [on line]. Barcelona: Edicions UPC, 1995 [Consultation: 04/03/2020]. Available on: http://hdl.handle.net/2099.3/36216. ISBN 8483014750.
- Olivella Puig, Joan. Teoría del buque : flotabilidad y estabilidad : problemas [on line]. Barcelona: Edicons UPC, 1995 [Consultation: 04/03/2020]. Available on: http://hdl.handle.net/2099.3/36372. ISBN 8476535562.
- Victoria Meizoso, Jesús Ramón. Principios de ingeniería naval. [s.l.]: Tórculo, 1997. ISBN 8489641390.
- Bonilla de la Corte, Antonio. Construcción naval y servicios. Vigo: San José, 1984. ISBN 843982629X.
- Clark, I. C. Stability, trim and strength for merchant ships and fishing vessels. 2nd ed. London: The Nautical Institute, 2008. ISBN 9781870077873.

Complementary:
- Acanfora, Maria; Cirillo, Antonio. "On the intact stability of a ship in head and following sea: an analysis of the dynamic roll angle due to sudden heeling moments". Journal of marine science and technology [on line]. Vol. 22, Núm. 4, des. 2017, p. 734–746

[Consultation: 04/03/2020]. Available on: https://doi-org.recursos.biblioteca.upc.edu/10.1007/s00773-017-0446-x.- Belenky, Vadim L.; Sevastianov, Nikita B. Stability and Safety of Ships Volume II. Risk of Capsizing. 2nd ed. Jersey: Society of Naval Architects and Marine Engineers, 2007. ISBN 0939773619.

- González López, Primitivo B. Técnicas de construcción naval. 2ª ed. A Coruña: Universidade de Coruña, 2005. ISBN 849749167X.

- Verney, Michael. Guía completa del mantenimiento y conservación de barcos. 3ª ed. Madrid: Tutor, 2008. ISBN 9788479022914.

- Murrant, Jim. Reparación de embarcaciones deportivas. [s.l.]: Libros Cúpula, 1990. ISBN 9788432919305.

- Manley, Pat. Mantenimiento sencillo de barcos. [Barcelona]: Noray, 2007. ISBN 9788474861730.

- González de Lema Martínez, Francisco Javier. Tecnología de la construcción del buque. 2a ed. A Coruña: Universidade da Coruña, 2007. ISBN 9788497492737.