

Course guide

280716 - 280716 - Ship Dynamics

Last modified: 09/05/2023

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

Degree: MASTER'S DEGREE IN NAUTICAL SCIENCE AND MARITIME TRANSPORT MANAGEMENT (Syllabus 2016).
(Compulsory subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: MARCEL·LA CASTELLS SANABRA

Others: Primer quadrimestre:
MARCEL·LA CASTELLS SANABRA - ERAS, MNGTM

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE9-MNGTM. Conocimiento del comportamiento del buque en la mar y de su maniobrabilidad.

Generical:
CG1-MNGTM. Capacitat per a gestionar, dirigir i coordinar l'anàlisi de les situacions, càlcul de variables i paràmetres específics de la navegació, la maniobra i del transport marítim.
CG2-MNGTM. Capacitat per a gestionar, dirigir i coordinar les tasques de la conservació i manteniment dels elements de coberta i espais de càrrega i estructura del vaixell.

CG3-MNGTM. Capacitat per mantenir la navegabilitat del vaixell en tot tipus de circumstàncies i condicions
CG6-MNGTM. Capacitat per planificar i realitzar els càlculs necessaris per a la distribució de la càrrega del vaixell, i la prevenció de sobreesforços estructurals

CG12-MNGTM. Capacitat per gestionar, dirigir i coordinar inspeccions de seguretat i protecció en els vaixells, proposant solucions tècniques als problemes detectats
CG15-MNGTM. (ENG) Capacidad para resolver problemas complejos y tomar decisiones con responsabilidad sobre bases científicas y tecnológicas en el ámbito de su especialidad
CG18-MNGTM. (ENG) Capacidad para dirigir y gestionar puertos deportivos

CG19-MNGTM. Capacitat per desenvolupar els coneixements per a l'anàlisi i interpretació de mesuraments, càlculs, valoracions, taxacions, peritatges, estudis, informes i documents tècnics en l'àmbit de la seva especialitat

CG21-MNGTM. (ENG) Capacidad para realizar tareas de investigación, desarrollo e innovación en el ámbito de su especialidad

Transversal:
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.



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.

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

MD1. Lectures

MD2. Participative lecturers

MD4. Self-study by solving exercises

MD5. Learning based in problems / projects

LEARNING OBJECTIVES OF THE SUBJECT

Acquire a basic knowledge of ship dynamics and how to predict ship motions in advance. Provide information on fundamentals of linear and non-linear ship motion in calm water and in waves. Establish a background of applied methods for description of natural ocean waves and calculation of forces and moments on ship due to sea loads and the resultant ship motion.

On the other hand, one of the objectives of this subject is provide the knowledge, understanding and proficiency of the competency "Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action" competency required and defined in Section A-II/2-13 (Mandatory minimum requirements for certification of masters and chief mates on ships of 500 gross tonnage or more) of the Seafarers Training, Certification and Watchkeeping (STCW) International Code.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	100.00

Total learning time: 45 h

CONTENTS

Chapter 1. Hull Strength

Description:

In this chapter longitudinal hull strength covers the relationship between the longitudinal distribution of the ship's buoyancy and the ability of the ship to cope with the internal and external stresses applied on it. The student will be aware of the limits of his vessel's allowable hull stress in port as well as at sea just as he knows what his ship's minimum required GM and conditions of trim are.

Knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces. Ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling competency (this knowledge is necessary in accordance with STCW Code Table A-II/2-13.1 and 13.2)

Full-or-part-time: 41h 40m

Theory classes: 3h

Self study : 38h 40m

Chapter 2. Representation of sea waves and seakeeping

Description:

This chapter describes the fundamental notions of representation of sea waves for further study of seakeeping of a vessel and introduces the necessary skills for carry out practices using the simulation program "Maxsurf Motions" successfully.

Full-or-part-time: 16h 40m

Theory classes: 3h

Self study : 13h 40m

Chapter 3. Waves and synchronism

Description:

This chapter presents the basic characteristics of the waves and their influence on the course and speed of the ship. Rolling and pitching synchronism is described. Basic knowledge about the classification and behavior of waves in front of some obstacles (refraction, reflection and diffraction) is also given.

Full-or-part-time: 41h 40m

Theory classes: 6h

Self study : 35h 40m

Chapter 4. Weather navigation. Dangerous situations in adverse weather and sea conditions

Description:

The main objective of this chapter is that students know about dangerous situations in adverse weather and sea conditions and how to avoid them considering weather navigation. Also, specific operation limitations of High Speed Crafts will be taken into account in this chapter

Full-or-part-time: 8h 20m

Self study : 8h 20m

Chapter 5. Ship maneuverability guidelines

Description:

This chapter treats about the maneuverability guidelines of a ship with the objective of having minimums acceptable, including the ability to move laterally (evolution and change of course) as well as the need to move laterally whenever it is not necessary (course stability). The requirements are studied according to the IMO regulation MSC 137 (76). Also this chapter describes the behavior and the operational limits of ships sailing at high speed.

Full-or-part-time: 8h 20m

Self study : 8h 20m

Chapter 6. Propeller and Rudder project and design guidelines

Description:

Explain the effect of rudder on manoeuvring of a ship. Rudder and propeller design.

Full-or-part-time: 8h 20m

Self study : 8h 20m



GRADING SYSTEM

The final mark is the result of the following assessment activities:

$$N_{\text{final}} = 0,35 N_{\text{fe}} + 0,35 N_{\text{pe}} + 0,30 N_{\text{ac}}$$

N_{final} : final mark

N_{fe} : final exam

N_{pe} : partial exam

N_{ac} : continuous assessment

The partial and final exams consist of questions (long and short answers) associated to the course learning objectives, concerning knowledge or comprehension and of practical exercises.

The continuous assessment (0,30) is the result of the following assessment activities:

$$N_{\text{ac}} = 0,15 N_{\text{ex}} + 0,15 N_{\text{ti}}$$

N_{ex} : Exercises

N_{ti} : assignments and reports

The continuous assessment consists of different exercises and tasks carried out during the course. This type of assessment also includes tests (mandatory but not evaluable).

The assignments and reports can be individual or cooperative activities. These assignments include an oral presentation.

Examination and assessment of chapter 1 will be using: stability, trim and stress tables, diagrams and stressâ€¦calculating equipment (A-II/2-13).

Evaluations are based on accepted principles, wellâ€¦founded arguments and correctly carried out. The decisions taken are acceptable, taking into consideration the safety of the ship and the prevailing conditions. (A-II/2-13)

EXAMINATION RULES.

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

BIBLIOGRAPHY

Basic:

- Master and chief mate : IMO model course ; 7.01. London: International Maritime Organization, 2014. ISBN 9789280115819.
- Barrass, C.B. Ship design and performance for masters and mates. Oxford: Elsevier, 2004. ISBN 0750660007.
- Olivella Puig, Joan. Teoría del buque : ola tricoidal, movimientos y esfuerzos [on line]. Barcelona: Edicions UPC, 1998 [Consultation: 24/02/2020]. Available on: <http://hdl.handle.net/2099.3/36646>. ISBN 8483012596.
- Baquero Mayor, Antonio. Maniobrabilidad del Buque. Madrid: Servicio de Publicaciones de la Escuela Técnica Superior de Ingenieros Navales, 2014.
- González Álvarez-Campana, José María. Comportamiento del buque en la mar : fundamentos. Versión 04.a. Madrid: Servicio de Publicaciones de la Escuela Técnica Superior de Ingenieros Navales, 2013. ISBN B15312586.
- González Álvarez-Campana, José María. Comportamiento del buque en la mar : aplicación. Versión 02.a. Madrid: Servicio de Publicaciones de la Escuela Técnica Superior de Ingenieros Navales, 2011.

Complementary:

- 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.
- Edward V. Lewis, editor. Principles of naval architecture. 3 vol. 2nd revision. Jersey City, NJ: The Society of Naval Architects and Marine Engineers, 1988-1989. ISBN 0939773007.



RESOURCES

Computer material:

- MAXSURF Software. Resource