

# Course guide 280672 - 280672 - Numerical Calculus of Naval Structures

		Last modified: 27/05/2024
Unit in charge:	Barcelona School of Nau	utical Studies
Teaching unit:	742 - CEN - Department	t of Nautical Sciences and Engineering.
Degree:	BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulso subject).	
Academic year: 2024	ECTS Credits: 4.5	Languages: Spanish, English

LECTURER				
Coordinating lecturer:	FERMÍN ENRIQUE OTERO GRUER			
Others:	Segon quadrimestre: FERMÍN ENRIQUE OTERO GRUER - DT1, DT2, GSTN1, GSTN2 FRANCESC TURON PUJOL - DT1, DT2, GSTN1, GSTN2			

# REQUIREMENTS

To take this course it is required to have approved the course 280669 - Estructures Aplicades a l'Enginyeria Naval

# **DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES**

#### Transversal:

1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

# **TEACHING METHODOLOGY**

To adquire, understand and synthesize knowledge Settting-up and resolution of problems To carry works out individually and in group To ellaborate technical reports To analyse results To relate knowledge among different disciplines

# LEARNING OBJECTIVES OF THE SUBJECT

To offer the student a basic knowledge about the theory supporting the linear static analysis using the Finite Element Method (FEM). To learn to use a professional software for analysis of naval structures using the FEM.

To give mainly practical criteria to analyse a naval structure, as well as to be able to evaluate the correctness of FEM results.

# **STUDY LOAD**

Туре	Hours	Percentage
Self study	67,5	60.00
Hours large group	45,0	40.00

## Total learning time: 112.5 h



# CONTENTS

## Chapter 1. Introduction to matrix structural analysis

#### **Description:**

Introduction to the numerical simulation of structures. Discrete and continuum systems. Matrix analysis of truss and beam structures. Introduction to GiD-Tdyn-Ramseries. Different practical applications.

#### Full-or-part-time: 3h

Theory classes: 3h

## Chapter 2. Introduction to the Finite Element Method (FEM)

#### **Description:**

Introduction to two dimensional and three dimensional elasticity. Stress and strain tensors. Stiffness matrix. Principal stresses. Application of the finite element method to 2D solids. Principle of the virtual work. Shape functions. Plain stress, plain strain and axilsymmetry.

Full-or-part-time: 3h

Theory classes: 3h

#### **Chapter 3. Introduction to GiD-Ramseries**

# Description:

Introduction to the pre/postprocessor system GiD. Geometry creation. Introduction to the structural analysis environment Ramseries. Sections and materials. Boundary conditions.

## Chapter 4. Analysis of beam structures with the FEM

#### **Description:**

Analysis of beam structures with the Finite Element Method

Chapter 5. Analysis of solid structures with the FEM

Chapter 6. Analysis of structures composed of plates, shells and beams with the FEM

Chapter 7. Naval applications of the FEM



# **GRADING SYSTEM**

The final mark will be the weighted average of all the different evaluating activities in the subject: Nfinal = 0.20·Nex + 0.40·Nec + 0.40·Ntc Nfinal: final mark Nex: mark of the partial exam Nec: mark of the different exercises and practices Ntc: mark of the final project The re-evaluation will consist of the solution of a práctical assignment defined by the professors. This work will be focused on the aspects of the matter failed by the student. It will be required to deliver a written report on the work at the day of the exam. Furthermore, the student could be asked for an oral presentation on the work.

# **EXAMINATION RULES.**

The student not presenting the proposed final project will be qualified as "not taken"

# **BIBLIOGRAPHY**

#### **Basic:**

- Blanco Díaz, Elena; Cervera Ruiz, Miguel. Mecánica de estructuras. Libro 2. Métodos de análisis [on line]. 2a ed. Ediciones UPC, 2002 [Consultation: 01/03/2023]. Available on: http://hdl.handle.net/2099.3/36196. ISBN 9788498802146.

- Oñate, E. Cálculo de estructuras por el método de elementos finitos, análisis estático lineal. Vol. 1, Sólidos. Barcelona: CIMNE, 2016. ISBN 9788494568978.

- Oñate, E. Cálculo de estructuras por el método de elementos finitos, análisis estático lineal. Vol. 2, Vigas, placas y láminas. Barcelona: CIMNE, 2019. ISBN 9788494919428.

## **Complementary:**

- Zienkiewicz, O. C.; Taylor, Richard Lawrence; Fox, D.D. The Finite element method : for solid & structural mechanics [on line]. 7th ed. Amsterdam [etc.]: Elsevier Butterworth-Heinemann, 2014 [Consultation: 19/06/2023]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9781856176347/the-finite-element-method-for-solid-and-structural -mechanics. ISBN 9781856176347.

- Bathe, Klaus-Jürgen. Finite element procedures. [S. I.]: l'autor, cop. 2006. ISBN 9780979004902.

- Harari, Yuval N. 21 lliçons per al segle XXI. Barcelona: Edicions 62, 2018. ISBN 9788429777826.