

Course guide

280672 - 280672 - Numerical Calculus of Naval Structures

Last modified: 25/10/2023

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: 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 acquire, understand and synthesize knowledge
Setting-up and resolution of problems
To carry works out individually and in group
To elaborate 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

Type	Hours	Percentage
Hours large group	15,0	13.33
Hours small group	30,0	26.67
Self study	67,5	60.00



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 axisymmetry.

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:

$$N_{\text{final}} = 0.20 \cdot N_{\text{ex}} + 0.40 \cdot N_{\text{ec}} + 0.40 \cdot N_{\text{tc}}$$

N_{final} : final mark

N_{ex} : mark of the partial exam

N_{ec} : mark of the different exercises and practices

N_{tc} : mark of the final project

The re-evaluation will consist of the solution of a practical 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. l.]: l'autor, cop. 2006. ISBN 9780979004902.
- Harari, Yuval N. 21 lliçons per al segle XXI. Barcelona: Edicions 62, 2018. ISBN 9788429777826.