

## SUBJECT TEACHING GUIDE

1492 - Calculus for Structural Analysis

Master's Degree in mining engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Master's Degree in mining engineering			Type and Year	Compulsory. Year 1
Faculty	School of Mines and Energy Engineering				
Discipline					
Course unit title and code	1492 - Calculus for Structural Analysis				
Number of ECTS credits allocated	4,5	Term	Semester based (2)		
Knowledge Field					
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA ESTRUCTURAL Y MECANICA				
Name of lecturer	JOSE RAMON IBAÑEZ DEL RIO				
E-mail	jose.ibanez@unican.es				
Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 2. DESPACHO (2063)				
Other lecturers	HAYDEE BLANCO WONG				

4. OBJECTIVES
That the student be able to carry out a calculation of efforts, tensions and movements in an articulated and reticulated structure.
Use a structure calculation program to solve problems.
Understand the philosophy of matrix calculation of structures.

6. SUBJECT PROGRAM	
CONTENTS	
1	Review of previous knowledge of Resistance of Materials
2	Articulated structures: <ul style="list-style-type: none"> <li>• Types of articulated structures</li> <li>• Calculation methods (knot method, Ritter method, resolution of lattices by assimilation to beams and unit force method as an application to Castigliano's energy theorem).</li> <li>• Simplifications by symmetry and antimetry.</li> </ul>
3	Reticulated structures: <ul style="list-style-type: none"> <li>• Concept of reticulated structure, translational and intra-translational structure.</li> <li>• Resolution of lattice structures by flexibility methods</li> <li>• Resolution of lattice structures by rigidity methods</li> <li>• Simplifications by symmetry and antimetry</li> </ul>
4	Lines of influence <ul style="list-style-type: none"> <li>• Reciprocity theorem (Maxell-Betti)</li> <li>• Line of influence of the vertical reaction in a support of a beam.</li> <li>• Line of influence of the moment in the embedment of a beam.</li> <li>• Line of influence of the shear at a point on a beam.</li> <li>• Line of influence of the bending at a point on a beam.</li> <li>• Determination of any static action (vertical reaction, embedment moment, shear or bending) in an isostatic beam from the line of influence.</li> </ul>
5	Introduction to matrix calculation of structures <ul style="list-style-type: none"> <li>• Stiffness matrix of a flat lattice bar in local axes</li> <li>• Stiffness matrix of a flat lattice bar in global axes.</li> <li>• Assembly of the rigidity matrix of a structure of articulated bars.</li> <li>• Statement of the matrix problem for a structure of articulated bars.</li> <li>• Stiffness matrix of a flat frame beam in local axes</li> <li>• Stiffness matrix of a flat frame beam in global axes.</li> <li>• Assembly of the rigidity matrix of a reticulated structure.</li> <li>• Statement of the matrix problem for a lattice structure</li> </ul>
6	Computer applications for the calculation of structures. <ul style="list-style-type: none"> <li>• Introduction to a commercial structure calculation program (ROBOT)</li> <li>• Application of the program to resolve articulated structures</li> <li>• Application of the program for the resolution of reticulated structures</li> </ul>

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Test 1	Written exam	No	Yes	35,00
Test 2	Written exam	No	Yes	35,00
Classroom exercises	Work	No	No	15,00
ROBOT Practice	Activity evaluation with Virtual Media	No	No	15,00
TOTAL				100,00
Observations				
Observations for part-time students				
For part-time students, only the two tests (with a weight of 40% each) and the ROBOT practice (with a weight of 20%) will be considered for passing the course.				

**8. BIBLIOGRAPHY AND TEACHING MATERIALS**

**BASIC**

1. Cálculo de estructuras. J.R. González de Cangas y A. Samartín Quiroga. Colegio de Ingenieros de Caminos, Canales y Puertos. Madrid 1999
2. Calculo matricial de estructuras. A. Samartin Quiroga y J.R. González de Cangas. Colegio de Ingenieros de Caminos Canales y Puertos. Madrid 2001.
3. Apuntes facilitados por el profesor