SUBJECT TEACHING GUIDE

1492 - Calculus for Structural Analysis

Master's Degree in mining engineering

Academic year 2026 - 2027

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	Architecture, construction, building and urban planning, civil engineering				
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: • Types of articulated structures • 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). • Simplifications by symmetry and antimetry.
3	Reticulated structures: • Concept of reticulated structure, translational and intra-translational structure. • Resolution of lattice structures by flexibility methods • Resolution of lattice structures by rigidity methods • Simplifications by symmetry and antimetry
4	Lines of influence • Reciprocity theorem (Maxell-Betti) • Line of influence of the vertical reaction in a support of a beam. • Line of influence of the moment in the embedment of a beam. • Line of influence of the shear at a point on a beam. • Line of influence of the bending at a point on a beam. • Determination of any static action (vertical reaction, embedment moment, shear or bending) in an isostatic beam from the line of influence.
5	ntroduction to matrix calculation of structures • Stiffness matrix of a flat lattice bar in local axes • Stiffness matrix of a flat lattice bar in global axes. • Assembly of the rigidity matrix of a structure of articulated bars. • Statement of the matrix problem for a structure of articulated bars. • Stiffness matrix of a flat frame beam in local axes • Stiffness matrix of a flat frame beam in global axes. • Assembly of the rigidity matrix of a reticulated structure. • Statement of the matrix problem for a lattice structure
6	Computer applications for the calculation of structures. • Introduction to a commercial structure calculation program (ROBOT) • Application of the program to resolve articulated structures • Application of the program for the resolution of reticulated structures

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessment	%
Final evaluation: Test 1	Written exam	Yes	Yes	35,00
Final evaluation: Test 2	Written exam	Yes	Yes	35,00
Work evaluation: Classroom exercises	Work	No	No	15,00
Practical Assessment: 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