SUBJECT TEACHING GUIDE

G1969 - Material Resistance

Degree in Civil Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering			Type and Year	Compulsory. Year 2
Faculty	School of civil Engineering				
Discipline	ANALYSIS AND TECHNOLOGY OF STRUCTURES				
Course unit title and code	G1969 - Material Resistance				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA ESTRUCTURAL Y MECANICA
Name of lecturer	HAYDEE BLANCO WONG
E-mail	haydee.blanco@unican.es
Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 2. DESPACHO (2066)
Other lecturers	JOSE RAMON IBAÑEZ DEL RIO YOSBEL BOFFILL ORAMA

3.1 LEARNING OUTCOMES
- 1. Identifies the mechanical and resistant behavior of structures based on their characteristics
- 2. Applies the fundamental concepts, laws and theorems of Strength of Materials: stresses and strains, displacements and deformations, energy deformation
- 3. It is capable of obtaining tensions in sections subjected to axial, bending, shear and torsional forces, including neutral fiber, central nucleus and shear center
- It is capable of analyzing structural elements subjected to traction, compression, torsion and bending
- 5. Calculate and represent the internal force and displacement laws in simple structural elements (beam, frame, lattice and arch)
- 6. Is able to analyze basic hyperstatic situations in simple structural systems
- 7. Obtains reactions, laws of internal forces and movements in hyperstatic elements by various methods.

4. OBJECTIVES
1. Introduction to the fundamental concepts of Strength of Materials: deformable solid, elastic behavior, linear stress and strain, tangential stress and strain, stress and strain. 2. Definition of the basic internal forces in structural sections: axial and shear forces, torsional and bending moments. Determination of stress diagrams. Stress analysis in cross sections. 3. Analysis of the deformations in basic structural elements: elements subjected to axial forces, torsion of circular section bars and bending of beams. Introduction to the study of hyperstatic structural elements. 4. Study of stress states derived from simple and compound efforts

6. COURSE ORGANIZATION	
CONTENTS	
1	1. STRESSES 1.1. Normal stress and linear strain 1.2. Mechanical properties of materials 1.3. Linear elasticity, Hooke's law and Poisson's ratio 1.4. Shear stress and angular strain
2	2. AXIALLY LOADED ELEMENTS 2.1. Length changes in axially loaded elements 2.2. Length changes in non-uniform bars 2.3. Hyperstatic structures 2.4. Thermal effects and previous deformations
3	3. TORSION 3.1. Torsional deformations in circular bars 3.2. Thin-walled tubes 3.3. Other cases of pure torsion
4	4. SHEAR FORCE AND BENDING MOMENT 4.1. Types of beams, loads and reactions 4.2. Shear forces and bending moments 4.3. Relations between loads, shear forces and bending moments 4.4. Shear stress and bending moment diagrams
5	5. NORMAL STRESSES IN BEAMS. BASIC TOPICS 5.1. Pure bending and simple bending 5.2. Normal stresses in beams 5.3. Dimensioning of bending sections
6	6. NORMAL STRESSES IN BEAMS. ADVANCED TOPICS 6.1. Skewed flexion 6.2. Compound bending 6.3. Central nucleus
7	7. SHEAR STRESSES IN BEAMS 7.1. Shear stresses in solid sections 7.2. Shear stresses in open thin-walled sections 7.3. Shear center concept
8	8. DEFORMATIONS OF BEAMS 8.1. Differential equation of the Elastic 8.2. Determination of rotations and deflections. Bresse formulas 8.3. Mohr's area theorems 8.4. Conjugate beam method
9	9. HYPERSTATIC BEAMS 9.1. Hyperstatic beam concept 9.2. Analysis of simple hyperstatic beams 9.3. Analysis of continuous beams 9.4. Analysis of hyperstatic systems 9.5. Analysis of simple frames

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Classroom practices 1 (thematic bloques 1-4)	Others	No	Yes	12,50
Classroom practices 2 (thematic bloques 5-7)	Others	No	Yes	12,50
Weekly test on the topics developed in class	Activity evaluation with Virtual Media	No	No	10,00
Robot Structural Analysis - Software training	Others	No	No	5,00
Final exam	Written exam	Yes	Yes	60,00
TOTAL				100,00

Observations

ORDINARY EVALUATION
Two conditions are required to pass the subject in the ordinary evaluation :
1. Get a grade equal to or greater than 5.0 out of 10.0, adding what was obtained in a) the evaluation activity with virtual support (10%), b) classroom practices (12.5% each), c) software training (5%) and d) final exam (60%)
2. Get a grade equal to or greater than 4 in the final exam.

EXTRAORDINARY EVALUATION
The grade will be the best of the grades obtained with the following criteria:
Criterion 1. The first criterion is similar to that of the ordinary evaluation, substituting the mark of the ordinary final exam for the one obtained in the extraordinary exam.
Criterion 2. The second criterion is obtained by assessing the extraordinary exam with a weight of 90% and the remaining 10% corresponding to the evaluation activity with virtual support.

REMOTE ASSESSMENT
Only for duly justified reasons (eg health restrictions) the evaluation tests may be organized remotely, with prior authorization from the Center Management

Observations for part-time students

Part-time students will be evaluated based on the grades obtained in the classroom practices and in the final exam. For this purpose, in the ordinary evaluation, the final exam will have a percentage of 70%, classroom practices of 12.5% each, and software training of 5%. In the extraordinary evaluation the qualification will be the one of the exam.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Resistencia de Materiales. James M. Gere. Editoral Thomson. ISBN: 84-9732-065-4