

Academic Year: ( 2022 / 2023 )

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Department assigned to the subject: Continuum Mechanics and Structural Analysis Department

Coordinating teacher: GARZON HERNANDEZ, SARA

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

## OBJECTIVES

By the end of this subject, students will be able to have:

1. Knowledge and understanding: Having basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as a knowledge of the Mechanics of Solids and Structures.
2. Engineering Analysis: Being able to identify engineering problems within the industrial field, recognize specifications, establish different resolution methods and select the most appropriate for their solution.
3. Research and Innovation: Being able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
4. Engineering Applications: Being able to apply their knowledge and understanding to solve problems, and design devices or processes in the field of industrial engineering according to criteria of cost, quality, safety, efficiency and respect for the environment.
5. knowledge and understanding of strength of materials and structural calculus.
6. awareness of the wider multidisciplinary context of engineering.
7. the ability to apply their knowledge and understanding to identify, formulate and solve problems of strength of materials and structural calculus using established methods;
8. the ability to design and conduct appropriate experiments, interpret the data and draw conclusions;
9. workshop and laboratory skills.
10. the ability to select and use appropriate equipment, tools and methods;
11. the ability to combine theory and practice to solve problems of strength of materials and structural calculus
12. an understanding of applicable techniques and methods in mechanics of structures, and their limitations;

## DESCRIPTION OF CONTENTS: PROGRAMME

### I: BEHAVIOUR OF REAL BODY EQUILIBRIUM AND CALCULUS OF REACTIONS FOR STRUCTURAL MECHANICS

#### Topic 1: FORCE SYSTEMS AND EQUILIBRIUM

##### 1.1 Main concepts

##### 1.2 Force systems and equivalent force systems

#### Topic 2: REACTIONS FORCES

##### 2.1 Computation of reactions in statically determinate structures

##### 2.2 Computation of reactions in statically indeterminate externally structures

#### Topic 3: MASS GEOMETRY

##### 3.1 Centre of mass of planar bodies

##### 3.2 Moment of inertia of planar bodies

## II: FORCE LAWS IN ISOSTATIC STRUCTURES

### Topic 4: FORCE LAWS (I)

#### 4.1 Concept and types of internal forces

#### 4.2 Relationship between load, shear force and bending moment

### Topic 5: FORCE LAWS (II)

#### 5.1 Determination of internal forces in simple beams

#### 5.2 Determination of internal forces in arches

### Topic 6: FORCE LAWS (III)

#### 6.1 Determination of internal forces for complex beams

#### 6.2 Determination of internal forces for frames

## III: TRUSS STRUCTURES AND CABLE STRUCTURES

### Topic 7: TRUSSES

#### 7.1 Internal forces for trusses

#### 7.2 Resolution procedures

### Topic 8: CABLES

#### 8.1 Cables under concentrated loads

#### 8.2 Cables under distributed loads

## IV: CONCEPT OF UNIAXIAL STRESS AND UNIAXIAL STRAIN

## RELATIONSHIP BETWEEN STRESS AND STRAIN IN ELASTIC SOLIDS

### Topic 9: DEFORMABLE BODY

#### 9.1 Main concepts. Cauchy stress

#### 9.2 Mechanical behaviour of solids

## V: PRINCIPLES OF STRENGTH OF MATERIALS. GENERAL STUDY OF STRUCTURAL BEHAVIOUR OF SECTION STRENGTH

### Topic 10: TENSILE/COMPRESSION (I)

#### 10.1 Principles of strength of materials

#### 10.2 Tensile and compressive axial force

### Topic 11: BENDING (II)

#### 11.1 Strength of materials. Bending (I)

#### 11.2 Pure bending

### Topic 12: BENDING (III)

#### 12.1 Strength of materials. Bending (II)

#### 12.2 Complex bending

## VI: INTRODUCTION TO EXPERIMENTAL METHODS FOR STRUCTURAL MECHANICS ENGINEERING APPLICATIONS

### 4 Laboratory sessions

## LEARNING ACTIVITIES AND METHODOLOGY

- Master class, sessions of questions resolution in reduced groups, students presentations, individual sessions, and personal student work for theoretical knowledge (3 ECTS).

- Practical sessions of laboratory and sessions of problems in reduced groups, individual sessions, and personal student work for practical knowledge (3 ECTS).

Additionally, collective tutorship can be included in the programme.

## ASSESSMENT SYSTEM

<b>% end-of-term-examination/test:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

Continuum assessment system based on short tests and laboratory reports.

Master class, sessions of questions resolution in reduced groups, students presentations, individual sessions, and personal student work for theoretical knowledge.

Practical sessions of laboratory and sessions of problems in reduced groups, individual sessions, and personal student work for practical knowledge.

A minimum grade of 4.5 in the final exam is required to take into account the continuum assessment.

In order to pass the course, the attendance and performance of the laboratory practices foreseen in the weekly planning are compulsory. The weighting of the laboratory practice mark in the continuous assessment corresponds to what it is established in the course, in accordance with the regulations of the university. In this subject, the weighting of the laboratory practices takes the value of 37.5% of the continuous assessment grade.

<b>% end-of-term-examination/test:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

#### BASIC BIBLIOGRAPHY

- F.P. Beer, E. Russel Johnston Vector Mechanics for Engineers., Vol. Static, McGraw Hill, 1994
- J. Case Strength of material and structures, Arnold, 1999
- J.M. Gere Mechanics of materials, Ed. Thomson, 2002
- W.M.C. McKenzie Examples in structural analysis, Taylor & Francis, 2006