Mechanics of Structures

Academic Year: (2022 / 2023) **Review date: 20-01-2023**

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

Coordinating teacher: NAYA MONTANS, FERNANDO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

OBJECTIVES

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

1. knowledge and understanding of strength of materials and structural calculus.
2. the ability to apply their knowledge and understanding to identify, formulate and solve problems of strength of materials and structural calculus using established methods;
3. the ability to design and conduct appropriate experiments, interpret the data and draw conclusions;
4. workshop and laboratory skills.
5. the ability to select and use appropriate equipment, tools and methods;
6. the ability to combine theory and practice to solve problems of strength of materials and structural calculus
7. an understanding of applicable techniques and methods in mechanics of structures, and their limitations;

DESCRIPTION OF CONTENTS: PROGRAMME

PART 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: REACTION FORCES
2.1 Introduction
2.2 Computation of reactions in statically determinate structures

Topic 3: REACTION FORCES (II)
3.1 Introduction
3.2 Computation of reactions in external statically indeterminate structures

PART 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 archs

Topic 6: FORCE LAWS (III)
6.1 Determination of internal forces in complex beams
6.2 Determination of internal forces in frames

PART 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

PART 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

PART 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

PART 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).

ASSESSMENT SYSTEM

Continuum assessment system based on short tests and laboratory reports. A minimum grade of 4.5 in the final exam (ordinary or extraordinary examination) 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 the subject Mechanics of Structures, the weighting of the laboratory practices takes the value of 37,5% of the continuous assessment grade.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Ferdinand Beer, Russell Johnston Ninth Edition. Vector Mechanics for Engineers. Statics., Mc Graw Hill. , 2007