Mechanics of Structures

Academic Year: (2021 / 2022) **Review date: 06-09-2021**

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

Coordinating teacher: GARCIA GONZALEZ, DANIEL

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

OBJECTIVES

Upon successful completion of this course, students will be able to:
1. Have knowledge and understanding of the principles of strength of materials and structural calculus.
2. Be aware of the multidisciplinary context of industrial engineering.
3. Have the ability to apply their knowledge and understanding to identify, formulate and solve material strength and structural calculation problems using established methods.
4. Ability to design and perform experiments, interpret data and draw conclusions.
5. Have technical and laboratory skills.
6. Have the ability to select and use appropriate equipment, tools and methods.
7. Be able to combine theory and practice to solve problems of material strength and structural calculation.
8. Have an understanding of applicable methods and techniques 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 archs

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 CROSS 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

3 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

Continuum assessment systemm based on reports, class participation and skills and knowledge tests.

A minimum grade of 4.5 in the final exam (either ordinary or extraordinary exams) 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 Vector Mechanics for Engineers, Vol. 1, Statics, Mc Graw Hill., 1994
- J. Case Strength of material and structures, Ed. Arnold, 1999
- J.M. Gere Mechanics of materials, Ed. Thomson, 2002
- W.M.C. McKenzie Examples in structural analysis, Taylor and Francis , 2006