Mechanics of Structures

Academic Year: (2023 / 2024) **Review date: 19/07/2023 11:07:13**

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

Coordinating teacher: IVAÑEZ DEL POZO, INES

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
COCIN1. Ability to draft, sign and develop projects in the area of industrial engineering for construction, renovation, repair, preservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, industrial plants and installations and automation and manufacturing processes.
COCIN3. Knowledge of basic and technological subject areas that will capacitate them to acquire new methods and theories and endow them with the versatility to adapt to new situations.
COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.
COCIN5. Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar jobs.
CEP3. Ability to design and carry out experiments to analyze and interpret data obtained.
CER8. Knowledge and use of the principles of materials resistance.

By the end of this content area, students will be able to have:
RA1.1. Knowledge and understanding of strength of materials and structural calculus.
RA1.2. A systematic understanding of the key aspects and concepts of mechanics of structures.
RA1.4. Awareness of the wider multidisciplinary context of engineering.
RA2.1. The ability to apply their knowledge and understanding to identify, formulate and solve problems of strength of materials and structural calculus using established methods.
RA4.2. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA4.3. Workshop and laboratory skills.
RA5.1. The ability to select and use appropriate equipment, tools and methods.
RA5.2. The ability to combine theory and practice to solve problems of strength of materials and structural calculus.
RA5.3. An understanding of applicable techniques and methods in mechanics of structures, and of their limitations.

OBJECTIVES

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

1. knowledge and understanding of strength of materials and structural calculus.
2. awareness of the wider multidisciplinary context of engineering.
3. the ability to apply their knowledge and understanding to identify, formulate and solve problems of strength of materials and structural calculus using established methods;
4. the ability to design and conduct appropriate experiments, interpret the data and draw conclusions;

5. workshop and laboratory skills.
6. the ability to select and use appropriate equipment, tools and methods;
7. the ability to combine theory and practice to solve problems of strength of materials and structural calculus
8. 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 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 STRENTH 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

Laboratory sessions

LEARNING ACTIVITIES AND METHODOLOGY

- Face-to-face teaching

- In order to pass the subject, attendance and completion of the laboratory sessions in the weekly planning are compulsory. The mark of lab practices in the continuous evaluation corresponds to what is established in the subject, in accordance with the university regulations. In the subject "Mechanics of Structures", the laboratory sessions take the value of 37.5% of the mark of the continuous evaluation (15/40).

ASSESSMENT SYSTEM

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

Continuum assessment system based on short tests and laboratory reports.
A minimum grade of 4.5 in the final exam is required to take into account the continuum assessment.

BASIC BIBLIOGRAPHY

- F.P. Beer, E. Russel Johnston Vector Mechanics for Engineers., Vol. Static, McGraw Hill, 1994

- J. Case Strength of material and structures, Ed. Arnold, 1999

- W.M.C. McKenzie Examples in structural analysis, Taylor & Francis, 2006