Mechanics of Structures

Academic Year: (2019 / 2020)   Review date: 07-05-2020

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

Coordinating teacher: SANCHEZ SAEZ, SONIA

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 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 STRENGHT OF MATERIALS. GENERAL STUDY OF STRUCTURAL BEHAVIOUR OF SECTION STRENGTH
Topic 10: TENSILE/COMPRESSION (I)
10.1 Principles of strenght 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 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.

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