UNICUSANO
ROME

Code: ICAR/08 (old) – 08/CEAR-06 (new) **Credits: 12**
Matter: Mechanics of Solids and Structures
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
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Introduction

1. *Objective of the course :*

The course of Basics of Mechanics of Solids and Structures aims to provide to the students the tools for understanding and applying the fundamentals of structural mechanics and of continuum mechanics. Furthermore, it want to promote the development of a critical learning process based not only on notional aspects but aimed at understanding and analyzing structural problems. Therefore, not only the theoretical bases, but also practical notions are provided, through exercises carried out on the topics covered within the lectures. The Etivity, associated with the course, develop the skills needed to the structural computation.

Objectives

1. *Course Structure:*

The course is organized in eight Sections. The first four sections concern the structural mechanics, while the last three sections are focused on the continuum mechanics. In the Section one, some basic physical and algebraic concepts are resumed and the kinematics of rigid bodies is explained. The second and third Sections refer to the equilibrium problem for mono-dimensional structures. In detail, the lectures are focused on the evaluation of the stress forces acting on equilibrated structures and on the beam theory, with which the deformed shape of elastic beams can be assessed. In the forth Section the methodology for solving hyperstatic structures is explained and applied. In the Section five the geometry of the areas is treated. In Section six the theory of stress and strain fields for Cauchy continuum bodies is explained. Sections seven and eight refer to the De Saint Venant theory for full and thin cross-sections respectively.

The student at the end of the course will have demonstrated to have acquired the knowledge related to the static of structures and the mechanical behaviour of continuous bodies. In detail, the student will be able to recognize the different structural types, he will master the static calculation of the structures, including: lability and kinematics of rigid structures, stress solicitations, deformed shape of beam-like members, methods of solving hyperstatic structures. Furthermore, the student will be able to compute the geometrical features of plane sections and he will be confident with the Cauchy continuum theory, including the stress and strain field concepts and the constitutive law for a linear elastic isotropic material. Finally, it will have a notion of the different stress and strain states acting on De Saint Venant, due to stresses such as: axial stress, bending, shear and torsion. The student will be able to use a "technical" language for the calculation of structures.

Competencies:

1. To evaluate the kinematics and statics of rigid bodies
2. To know the static structural analysis
3. To acquire the ability to analyse deformable solids
4. To be able to solve hyperstatic structures
5. To evaluate the calculation of the geometry of the areas of plane shape
6. To know and understand the stress and deformation fields for continuum bodies
7. To evaluate the stress and strain state of beam-like members through the De Saint Venant theory.

Syllabus

2. *Programme of the course:*

Subject 1. The rigid body
Subject 2. Equilibrated beam-like structures
Subject 3. Beam theory:deformed shape
Subject 4. Hyperstatic structures
Subject 5. Geometry of areas
Subject 6. Continuum mechanics
Subject 7. De Saint Venant theory
Subject 8. De Saint Venant theory for thin cross-section beam

Evaluation system and criteria

The exam consists on a written test aimed at accertaining the abilities to analyze and re-elaborate the acquired concepts and a series of activities (5 Etivities) carried out during the course.
The evaluation of the Etivities from 0 to 1 points (2 points for each of the five Etivities), is carried out during the course. The written test is done by the student in 3:00h, divided into two parts:

- Part 1 of 1:30h associated to Subject 1, Subject 2, Subject 3 and Subject 4 with Etivities from 1 to 3.
- Part 2 of 1:30h associated to Subject 5, Subject 6, Subject 7 and Subject 8 with Etivities from 4 to 5.

The Part 1 is evaluated with a score from 0 to 24 points, to which the score from 0 to 6 points obtained from the Etivities is added.
The Part 2 is evaluated with a score from 0 to 26 points, to which the score from 0 to 4 points obtained from the Etivities is added.
In detail, for each part the evaluation is as follows:

- exercise - maximum 18 points;
- theory questions - maximum 6-8 points.

The exam is considered passed with a global score of 18 for each part. The final vote is the average of the votes obtained from the two parts.

Bibliography and resources

3. *Materials to consult:*

The slides and lessons available in the web-platform.

4. *Recommended bibliography:*

- Structural Mechanics Fundamentals, A. Carpinteri, CRC Press
- Structural Mechanics: A unified approach, A. Carpinteri, Taylor and Francis