UNICUSANO
ROME

Code: ICAR/08 **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 Mechanics of Solids and Structures aims to provide to the students the tools for understanding and applying the fundamentals of structural mechanic and of continuum mechanic. 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 evaluate the structural types, to select the calculation methods and use them for the structural computation.

Objectives

2. *Course Structure:*

The course is organized in eight Sections. The first four sections concern the structural mechanic, the following subjects are about the continuum mechanic. In the Section one, some basic physical and algebraic concepts are reported and the mechanic of rigid bodies is addressed. The second and third Sections refer to the evaluation of the solicitations acting on isostatic structures and to the beam theory, with which the deformed shape of elastic beams can be defined, respectively. 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 know the calculation of the geometry of the areas and the theory about of the stress and strain fields for continuous bodies and will know the definition and the concept of isotropic linear elastic material. Finally it will have a notion of the different stress and strain states acting on De Saint Venant solids consisting of solid or thin sections, 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

3. *Programme of the course:*

Subject 1. The rigid body
Subject 2. Isostatic structures: definition and evaluation of solicitations
Subject 3. Beam theory
Subject 4. Hyperstatic structures
Subject 5. Geometry of areas
Subject 6. Continuum mechanics: stress and strain fields
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 Etivity from 0 to 5 points (1 points each), is carried out during the course. The written test is done by the student in 1:30h.
The written exam foresees:
- one or more exercises (number determined according to the degree of difficulty);
- 10 questions with open answers;
- 1 question of theory.

The exam is evaluated with a score from 0 to 25 points, to which the score from 0 to 5 points obtained in Etivity1-2-3 is added. In detail, the evaluation is as follows:

- exercises - maximum 10 points;
- questions - maximum 10 points;
- theory question - maximum 5 points.

To these votes the maximum score of 5 points of Etivities is added.
The exam is considered sufficient with a global score of 18.

Bibliography and resources

4. *Materials to consult:*

The slides and lessons available in the web-platform.

5. *Recommended bibliography:*

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