



**Code: ICAR/08**

**Credits: 6**

**Matter: Basics of 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 mechanic and of continuum mechanic. Furthermore, it wants 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 Ectivity, associated with the course, develops 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 six Sections. The first three 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 mechanics 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 Section four 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.

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: stability and kinematics of rigid structures, stress solicitations, deformed shape of beam-like members. 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, 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 evaluate the calculation of the geometry of the areas of plane shape
5. To know and understand the stress and deformation fields for continuum bodies
6. 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. Geometry of areas**

**Subject 5. Continuum mechanics: stress and strain fields**

**Subject 6. De Saint Venant theory**

### **Evaluation system and criteria**

The exam consists on a written test aimed at ascertaining the abilities to analyze and re-elaborate the acquired concepts and a series of activities (2 Etivities) carried out during the course.

The evaluation of the Etivity from 0 to 3 points (2 points Etivity A – 1 point Etivity B), 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 27 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 12 points;
- questions - maximum 10 points;
- theory question - maximum 5 points.

To these votes the maximum score of 3 points of Etivity A-B 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