



UNIVERSITÀ DI PISA

STRUCTURAL FORMS FOR DESIGN

SILVIA CAPRILI

Anno accademico
CdS

2023/24
ENGINEERING FOR THE INDUSTRIAL
DESIGN
248HH
6

Moduli
FORME STRUTTURALI
PER IL DESIGN

Settore/i
ICAR/09

Tipo
LEZIONI

Ore
60

Docente/i
SILVIA CAPRILI
FRANCESCA MATTEI

Learning outcomes

Knowledge

The course aims to provide the students the skills necessary to design elements and structures typical of design, with particular reference to problems of resistance, deformation and buckling and to the adoption of different materials. At the end of the course, students will own the necessary tools for a critical examination and the conceptual design and structural design of design objects.

Assessment criteria of knowledge

Oral Examination with eventual exercise.

Skills

Conceptual design of the object
Selection of the most efficient material for the realization of the design object
Structural design of the components

Assessment criteria of skills

Oral Examination

Behaviors

The student will be able to acquire and/or develop sensitivity to the general problems of structural design, such as the choice of simplified static schemes for sizing, selection of the most suitable material, etc. The student will be able to organize/manage a design group.

Assessment criteria of behaviors

In the case of presentation of an exercise, the student will demonstrate the skills developed at the design level, in terms of managing the different design phases.

Prerequisites

Basic knowledge of material science and engineering.

Syllabus

General introduction. From "Conceptual design" to the definitive/executive design of the system (object/furniture/component).

Materials and material strength. Choice of material based on project requirements. Metallic materials, glass and ceramic materials, composite and polymeric materials, wood. Determination of the main characteristics: strength, stiffness, deformability, toughness (mechanical), cost and weight, durability.

The design of objects. Prevention of structural collapse: resistance, deformability, buckling. General criteria for effective design of components. Typical examples of one- and two-dimensional systems with reference to static functioning: ropes, rods and beams, arches, slabs, plates and membranes. Review of basic principles of static of the structures: the rigid body equilibrium, cardinal equations of statics. Definition of significant static schemes depending on the project to be carried out. Choice of restraints/constraints and classification. Determination of stress solicitations. Examples and practical applications.

Evaluation and application of external actions. Types of load (concentrated/distributed linear and superficial). Classification of loads based



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on duration, definition of permanent loads and variable actions (snow/wind/exercise) with reference to NTC2018 and/or Eurocodes. Combination of actions and determination of demand.

Principles and methods for safety assessment. Elastic calculation and inelastic calculation for capacity evaluation. Semiprobabilistic method for safety assessment: comparison between capacity and demand.

Safety and design checks. Assessment for simple and combined conditions (compression/traction, bending, shear, torsion, pressure/tensile bending, bending and shear) in terms of strength. Applications to practical cases and specifications depending on the type of material used. Buckling instability and lateral-torsional buckling, theoretical formulation and practical applications with reference to the type of material used. Deformability (functionality).

Construction details. The connections, typologies and general sizing depending on the type of element/material used

Bibliography

Appunti delle lezioni del docente.

I seguenti testi possono essere utilmente consultati.

- Campanella, Introduzione alla meccanica delle strutture per il design, Aracne editrice
- Del Curto, C. Marano, Materiali per il design. Introduzione ai materiali e alle loro proprietà, Casa Editrice Ambrosiana
- Silver, W. McLean, Introduction to architectural technology, Editore: Laurence King

Updated: 02/11/2023 16:33