Degree course	Science of Architecture
Course code	16592
Lecturer	Aurora Angela Pisano
Course name	Static
Disciplinary area	Civil Engineering and Architecture
Disciplinary field of science	ICAR/08 Solids and Structural Mechanics
University credits - ECTS	8
Teaching hours	80
Course year	Second
Semester	First

Synthetic description

The Course has as main objective the understanding of the physical-mechanical behavior of civil construction and structures in general and this by identifying in them the recognizable structural elements. A subsequent step is to study the analytical models able to represent the above structural elements. The Course, trying to reconcile intuition and analytical rigor, it is proposed to provide the student with the basic knowledge and the analytical tools needed for the above quoted process of knowledge and understanding. All the topics will be proposed taking inspiration from real problems, generally drawn from the world of ordinary buildings but also, at the same time, that of the "design" or even of structures made in steel, wood, composite.

Course entry requirements

Prerequisites: calculus.

Course programme

Detailed course program

Introduction to the Theory of Equilibrium: Statics as a discipline that, as part of Classical Mechanics, studies the Equilibrium Theory; the concept of force conceived as a directional entity; the concepts of action, structure, constrain and reaction force.

The static problem: the internal problem and the constraints reactions; the external problem and the internal stresses and strains.

Elements of the theory of vectors: scalar and vector quantities, free vectors and applied vectors; some vector operations: sum, difference, scalar and vector product.

Some simple equilibrium problems: the problem of the fixed pulley, the problem of the inclined plane, the pulley systems; Stevin' experiments.

Statics and kinematics of a rigid unconstrained body: basic concepts; definition of a rigid body ; configuration of a rigid body in space and in plane, the principle of virtual work, the fundamental equations of statics.

Classification of the structures: introductory concepts; classification according to their geometric shape; classification on the base of their mechanical behavior; structural models.

External actions or loads: basic concepts; external actions as distributed loads on structures; mathematical models of external actions.

Static and kinematic of a rigid constrained body: particularization to the planar problem, the beam; constrain devices; the equilibrium equations for rigid constrained bodies; rigid structures with degree of freedom, statically determinate structures and statically undeterminate structures ; constraints in real world; evaluation of the reaction forces.

The internal forces and moments in beams: particularization to the planar problem; diagrams of the internal forces and moments; differential equations for internal forces; diagrams of internal forces and moments.

Static, kinematic and internal forces in beams' system: the internal constraints; isostatic conditions of beams' system; calculation of reaction forces through graphic and analytic process; diagrams of internal forces in beams' systems.

Kinematics of constrained rigid bodies: the kinematic chains, compatibility equations, equilibrium equations; failure mechanisms.

The trusses structures: recurring types and classification of trusses, the planar trusses, real-world examples; determination of normal stresses in the single truss: the method of the equilibrium of nodes, the Ritter's method.

Geometric characteristics of sections: Centroid and first moment of areas, inertia moments, principal axes, ellipsoid of inertia.

Examples

Expected results

Knowledge of the physical and mechanical principles necessary for an understanding of the static behavior of the structure.

Acquisition of a general methodology for the solution of what in the course is identified as a problem of analysis (in static field) of a structural element, the latter always formulated with reference to structural problems of the real-world constructions.

Course structure and teaching

Lectures *(hours/year): 60*
Exercises *(hours/year): 20*

Student's independent work

Exercises.

Testing and exams

The acquired knowledge will be verified through written tests, to be incurred during and / or at the end of the course, and a colloquium on the more theoretical aspects. The final evaluation will take into account the

degree of student learning, the skill to apply and argue the acquired knowledge.

Suggested reading materials

Textbooks

G. Muscolino, G. Falsone, Introduzione alla Scienza delle Costruzioni. Statica e Cinematica delle travi, Ed. Pitagora, Bologna, 1991.

O. Belluzzi, Scienza delle Costruzioni – vol. I, Ed. Zanichelli, Bologna, 1982.

S. Di Pasquale, C. Messina, L. Paolini, B. Furiozzi- Nuovo Corso di Costruzioni- Vol. 1, 2. Le Monnier 2009.

E. Viola, Esercitazioni di Scienza delle Costruzioni – vol. I: Strutture Isostatiche e Geometria delle Masse, Ed. Pitagora, Bologna, 1977.

Esercizi svolti -- http://www.pau.unirc.it/scheda_persona.php?id=680.