UCLouvain

ltarc1160

2024

Structural Analysis 1 : fundamentals of statics and strength of materials

4.00 credits	20.0 h + 30.0 h	Q2

Teacher(s)	Faux Pascaline ;
Language :	French
Place of the course	Tournai
Main themes	This teaching unit provides an introduction to the understanding of the mechanical working of load-bearing structures and their analysis. It forms part of the continuous process of studying the main architectural structures. This teaching unit will provide the main concepts designed to: • analyse simple linear structures by means of tools from statics and materials resistance. • maintain a dialogue with an engineer specialised in this field. • The following topics are covered: • Basic concepts in mechanics: force and moment • Characteristics of sections: centre of gravity, quadratics, main axes of inertia • Balance conditions of simple isostatic structures: hypotheses, force systems, support reactions • Internal loads and associated constraints: assessment and quantification • Mechanical properties of materials and deformation.
Learning outcomes	**At the end of this learning unit, the student is able to :** **Specific learning outcomes:** By the end of the course, students are able to • apply the fundamental principles of statics in the case of flat structures subject to the action of a system of forces. • produce the static diagram corresponding to a simple loaded structure. • use graphic methods applied to questions of statics, enabling the visualisation of forces understanding of their effects on the structure being studied. • use analytical instruments applied to the principle of balance of a flat structure, to the calculations of the reactions at the supports, to establishing internal loads and associated constraints. • undertake a critical analysis of simple extended, compressed or bent structures subject to usual loading. • formulate the mechanical properties of common materials - steel, wood, concrete and glass : law of behaviour, fragility and ductility. 1 • formulate the resistance conditions of a structure with regard to geometric factors and stress of the selected material. **Contribution to the learning outcomes reference framework:** With regard to the learning outcomes reference framework of the Bachelor's degree in Architecture, this teaching unit contributes to the development, the acquisition and the assessment of the following learning outcomes: **Make use of other subjects** • Interpret the knowledge of other subjects **Use the technical dimension** • Be familiar with and describe the main technical principles of building • Acquire an instinctive understanding of structures to use in producing a creative work of architecture
Evaluation methods	Written examination of theory and exercises, in session. Minimum attendance at practice sessions may be required to sit the exam.
Teaching methods	Theory: 2h/week lecture. The power point is made available to students, who must complete it with their own notes. Exercises: small group sessions, 2h/week. Syllabus of exercises made available to students. Supervised session work, correction of certain exercises during sessions. Compulsory student attendance at exercise sessions.
Content	The course is given in two parts: 1. Theoretical lectures Theory of static mechanics and its application to the analysis of typical structures: funicular structures: cables

	Vector structures: lattices Bending structures: beams Each analysis is developed in 6 key stages: static diagram, detailing, loads, internal forces, dimensioning (permissible stress and verification of deformation), supports. 2. Exercise sessions Manipulation of graphical and analytical tools for static mechanics and strength of materials, in 5 modules: Forces and static equilibrium Support reactions of isostatic systems Normal forces in funicular and vector (lattice) structures: finding internal forces using graphical (Cremona) and analytical (Ritter) methods. Internal forces in bending beams: shear force and bending moment diagrams. Properties of cross-section geometry: static moment and center of gravity, moment of inertia, calculation of deflection, deformation, etc.
Bibliography	Leyral M., *Faire tenir, Structure et architecture*, Editions de La Villette, 2021 Allen E., Zalewski W., "Form and Forces, Designing efficient, expressive structures", Boston, Wiley, 2010 Muttoni A., "L'art des structures", Lausanne, PPUR, 2004 Studer M-A. & Frey Fr., "Introduction à l'analyse des structures", Lausanne, PPUR, 1997 Meistermann A., "Basics - Systèmes porteurs", Birkhäuser, 2007
Faculty or entity in charge	LOCI

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Architecture (Tournai)	ARCT1BA	4		