UCLouvain

lbarc1360

2024

Building mechanical systems and comfort

4.00 credits	40.0 h	Q1

Teacher(s)	Bodart Magali ;Van Moeseke Geoffrey ;
Language :	French
Place of the course	Bruxelles Saint-Gilles
Prerequisites	*The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	This teaching unit covers all the aspects linked to architectural and technological measures designed to ensure quality of atmosphere. In particular, it covers: • visual comfort and techniques for natural and artificial lighting • acoustic comfort and techniques for acoustic correction and insulation • thermal comfort, bioclimatic architecture and techniques for heating and cooling • air quality and ventilation techniques. This teaching unit develops the link between the perception of comfort, the relevant regulatory and technological aspects and their architectural consequences in terms of space. In this way, it provides students with the necessary foundations to eventually bring these topics into their practice as designers, in the context of European regulation imposing on buildings the requirement to be 'nearly zero-energy' by 2020.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 This teaching unit focuses particularly on two dimensions of the profile of a Bachelor level graduate in Architecture: developing a technical dimension and making use of other disciplines. **Specific learning outcomes:** In particular, by the end of this course, students will be able to • present a well-argued energy design plan for architectural projects in the current climatic, regulatory and environmental context. • describe the role and the working of the main equipment in ventilation, heating, cooling, artificial lighting and production of renewable energy in terms of a building. • use the normal sizing rules to pre-size ventilation, heating, cooling and artificial lighting installations to ensure air quality and thermal comfort. • clarify the basic concepts linked to the perception and the propagation of sound and the principles of acoustic correction. • apply these concepts to simple problems of assessing the level of acoustic insulation against the airborne noises of walls, propagation of impact noise and acoustic correction (room acoustics). **Contribution to the learning outcome reference framework:** **Make use of other subjects** • Seek out other approaches, exchanges of views and ways of enhancing thinking about architecture • Interpret the knowledge of other subjects • Make use of other subjects to ask questions about the design and implementation of an architectural project **Use the technical dimension** • Be familiar with and describe the main technical principles of building • Observe and assess the main construction principles of a building • Be able to apply the various basic technical principles in a producing a work of architecture

Evaluation methods	It is a written exam in several parts with different modalities, which consists of: • Part A consisting of multiple choice questions with 4 suggested answers and an expected correct answer worth 1 point. This part aims to validate the mastery of a threshold of learning outcomes. • Part B, including open questions related to the different chapters of the course. This part aims to promote advanced mastery of learning outcomes. Students can be exempted from the questions relating to the “visual comfort” chapter of this part by carrying out an analysis of the lighting in a given space. The mark obtained in this work represents 25% of the total for this part of the exam. This work can not be redone during the augustus session. On the final score, part A is worth 10/20 and part B is worth 10/20.
Teaching methods	For the visual and acoustical comfort parts: Learning is based on magistral lectures while promoting interaction between teachers and students. The independent work of the student will be encouraged and framed implementation exercises and preliminary readings or as an extension of the presentations. For the thermal and respiratory comfort parts: Learning is based on the principle of inverted classes. The contents are made available in different formats (DUC syllabus, SlideShare presentations and FOLD structuring accessible from moodle). The supervised sessions are the place to answer students' questions, exercises and preparatory tests.
Content	This course deals with all the aspects linked to architectural and technological measures aimed at ensuring the quality of the indoor environment. In particular, it addresses: • Visual comfort : techniques of natural and artificial lighting • Acoustic comfort : acoustic correction and insulation techniques • Thermal comfort : bioclimatic architecture and HVAC techniques • Air quality : ventilation techniques. This teaching unit develops the link between the perception of comfort, the related regulatory and technological aspects, and their architectural consequences at the scale of spaces. In doing so, it gives students the bases necessary for the subsequent integration of these themes into their practice as designers, in the European regulatory context requiring “nearly zero-energy” buildings by 2020. The principle followed in this course is based on an identical approach for each types of comforts discussed. It starts by developping the physical concepts necessary for the understanding of each particular comfort domain. Then comes the teaching of metrics and indicators making it possible to qualify and quantify comfort, the strategies to be put in place to ensure comfort and finally a description of the equipment which comes to supplement the “natural and sustainable” techniques, in a “nearly-” context. zero energy buildings ". **Visual comfort** The UE begins with a description of the basic physical concepts of photometry, necessary to define the metrics used in lighting (natural and artificial). It then discusses the parameters of perception and visual comfort. Once these concepts have been acquired, the strategies of natural lighting are described. The techniques of electric lighting, as a complement to natural lighting are finally approached. **Acoustical comfort** This part of the course begins with the definition of the basic concepts of acoustics as well as the reminder of the essential mathematical concepts as a preamble to the study of the perception and the propagation of sound. The study of echo and reverberation phenomena is then used as a basis for the study of acoustic correction, which makes it possible to approach the sound absorption techniques to be implemented in the building. The second major part related to acoustic comfort is the study of acoustic insulation against airborne noise and the propagation of impact noise. Protection techniques against these two types of noise are then studied, under European regulations. **Air quality** This part begins with the inventory of sources of air pollution in buildings, and justifies a design strategy based on the avoidance of sources as a prerequisite for the dilution of pollutants. The sizing standards for ventilation systems are then discussed. The ventilation equipment is presented in their overall logic (natural systems, single and double flow mechanics), with an emphasis on techniques for diffusing air into the environment. **Thermal comfort** This section addresses the current debates on the scientific definition of thermal comfort (thermodynamic, adaptive, alliesthesia models) and the parameters involved. A reminder of the concepts of heat transfer is proposed, as a basis for the discussion on the choice of thermal emitting equipment intended for heating and cooling (radiant / convective, inert / reactive). The sizing standards for heating and cooling loads are presented, as well as the impact of the choice of thermal emitter on the heat production and distribution systems, which will be briefly outlined.
Bibliography	Les étudiants disposent d'un syllabus pour chaque enseignant. Les présentations PowerPoint sont mises à leur disposition après chaque séance de cours (partie confort acoustique et visuel), ou avant (partie confort thermique et respiratoire).
Faculty or entity in charge	LOCI

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Architecture (Bruxelles)	ARCB1BA	4	LBARC1260	🔍