

Course Unit	Building Technology I		Field of study	Technology and Construction Materials														
Bachelor in	Civil Engineering		School	School of Technology and Management														
Academic Year	2022/2023	Year of study	2	Level	1-2													
Type	Semestral	Semester	2	ECTS credits	6.0													
Code			9089-322-2202-00-22															
Workload (hours)	162	Contact hours	T	15	TP	45	PL	-	TC	-	S	-	E	-	OT	-	O	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Maria Isabel Lopes Marcelino Dias de Abreu

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Know how to use low energy strategies for building design that work with energy conservation, passive and active solar heating systems, passive cooling technologies and energy efficiency in general.
2. Apply the thermal regulations methodology and the standards for natural ventilation to residential buildings.
3. Understand the mechanisms of materials hygroscopicity and condensation dampness problems together with the principals to apply in the design of building.
4. Identify and detail the most used building technologies.
5. Know how to execute fundamental building technologies at the work site.

### Prerequisites

Not applicable

### Course contents

Functional requirements in buildings; Principles for designing passive and NZEB buildings; Thermal behaviour and energy efficiency in residential buildings; Thermal Regulations - REH; Hygrothermal behavior and dampness in buildings; Airtightness and natural ventilation in buildings; Building and construction technology.

### Course contents (extended version)

1. Functional requirements in buildings; Principles for design with passive solutions; NZEB buildings.
2. Thermal behaviour, passive solutions and energy efficiency. Thermal regulations. NZEB buildings.
  - Heat transfer mechanisms; External climate characterization; Indoor thermal comfort issues.
  - Identification of passive solutions for different climates; Givoni chart.
  - Portuguese regulations for energy performance of buildings.
  - Heating period - Energy conservation and thermal insulation technology.
  - Heating period - Heat storage capacity and passive solar heating systems.
  - Cooling period - Passive cooling strategies Performance to solar radiation and solar protection.
  - Cooling period - Ventilation and thermal inertia.
  - Heating and cooling systems; Energy renewable systems. ; Active solar systems; DWH systems.
3. Hygrothermal behavior and dampness in buildings.
  - Water vapour movement mechanisms; Diagnostics and effects of dampness.
  - Indoor spaces humidity load.
  - Condensation: Surface condensation; Building design to prevent condensation.
  - Hygroscopic materials.
4. Airtightness and natural ventilation in buildings.
  - Basic concepts for natural ventilation; wind and buoyancy driven ventilation.
  - Natural ventilation design systems for residential buildings. Passive stack and cross ventilation.
5. Building and construction technology.
  - Earthwork and building site preparation
  - Retaining wall systems. Structural retaining walls and soil nailing
  - Foundations.
  - Reinforced concrete structures; Formwork systems.
  - Building facade technologies; Openings and solar shading devices. External wall finishes.
  - Pitched roofs and flat roofs; Floors, slabs and floor finishes.
  - Indoor walls and building wall finishes.

### Recommended reading

1. Regulamento de Desempenho Energético dos Edifícios de Habitação (REH), Decreto-Lei nº 118/2013 de 20 de Agosto
2. Gonçalves, Hélder; Graça, João Mariz, (2004) Conceitos Bioclimáticos para os Edifícios em Portugal, INETI.
3. FREITAS, Vasco Peixoto de; PINTO, Paulo da Silva, (1998) Permeabilidade ao Vapor de Materiais de Construção – Condensações Internas, Nota de Informação Técnica – NIT 002 – LFC 1998, LFC- FEUP, Porto.
4. NP 1037 - 1 2002 - Ventilação e evacuação dos produtos da combustão dos locais com aparelhos a gás - Parte 1: Edifícios de habitação. Ventilação natural, Lisboa, IPQ.
5. Mascarenhas, Jorge, Sistemas de Construção, Volume I; II; III, IV, V, VI, Livros Horizonte, Lisboa.

### Teaching and learning methods

Lectures (using visual resources); Practical examples alternate with analysis and discussion of subjects proposed by the teacher (web contents and videos); Presentation and sharing of practical works (individual and in collaborative mode) made by the students during the class time or out of it. Non-contact hours: Practical works.

### Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
  - Practical Work - 70%
  - Final Written Exam - 30%

### Language of instruction

Portuguese, with additional English support for foreign students.

## Electronic validation

Maria Isabel Lopes Marcelino Dias de Abreu	Jorge Pedro Lopes	António Miguel Verdelho Paula	José Carlos Rufino Amaro
04-03-2023	10-03-2023	10-03-2023	17-03-2023