

Course Unit	Building Physics	Field of study	Technology and Construction Materials		
Master in	Construction Engineering	School	School of Technology and Management		
Academic Year	2023/2024	Year of study	2	Level	2-2
Type	Semestral	Semester	1	ECTS credits	6.0
Code	5024-419-2102-00-23				
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. Implement sustainable, passive solar design and energy efficient principles in building design for new buildings and for building renovation;
2. Know how to analyse and propose passive and active energy solutions for a building together with an investment analysis study;
3. Refer the principles of natural ventilation for residential buildings;
4. Know how to select the materials and building elements to avoid interstitial condensation, to ensure the necessary hygroscopicity in the building indoor and provide waterproofing;
5. Apply the legal framework related to fire protection and safety systems in a building;
6. Recognize the most usual acoustic renovation solutions for sound absorption in rooms, airborne and impact sound insulation in buildings.

### Prerequisites

Before the course unit the learner is expected to be able to:

Demonstrate knowledge consistent with a first degree course in the civil engineering studies.

### Course contents

Safety, comfort and health requirements in buildings. Sustainable construction. Passive design, energy efficiency and low energy building renovation. Air tightness and natural ventilation in buildings. Moisture and dampness problems in buildings. Fire protection and safety in buildings. Acoustic renovation in buildings.

### Course contents (extended version)

1. Safety, comfort and health requirements in buildings.
2. Sustainable construction. Passive design, energy efficiency and low energy building renovation.
  - Basic principles; The site layout; Indoor comfort; Sustainable housing principles.
  - Sustainable building materials; Energy, pollution, embodied energy, resources and waste; LCA.
  - Vernacular architecture; Selection of passive and active building design solutions based on climate.
  - Energy conservation and thermal insulation technology; Air tightness and ventilation in cold season.
  - Passive solar heating and thermal mass systems.
  - Solar protection and passive cooling systems. Night ventilation.
  - Design principles for daylighting.
  - Building heating systems; Active solar space and domestic hot water (DHW) heating systems.
  - Regulations and building energy performance certification - NZEB, ZEB e PEB.
  - Low-energy building renovation.
3. Airtightness and natural ventilation in buildings.
  - Passive stack ventilation and cross ventilation principles.
4. Moisture and dampness problems in buildings.
  - Diagnostic and effects of dampness. Psychrometry and humidity load in indoor spaces.
  - Condensation; Design solutions to avoid interstitial condensation.
  - Hygroscopic materials.
5. Fire protection and safety in buildings.
  - Basic principles about fire.
  - Fire spread mechanisms and fire suppression.
  - Calorific power and fire load.
  - Materials reaction to fire and fire resistance.
  - Portuguese fire protection and safety regulations.
  - Building design for fire protection and safety; Active and passive systems (AFP and PFP).
  - Fire safety management and fire emergency plan.
6. Acoustic renovation in buildings.
  - Room acoustics. Absorptive materials for inner spaces renovation.
  - Airborne sound insulation solutions. Walls, floors and openings.
  - Impact sound insulation solutions. Floors.

### Recommended reading

1. Regulamento de Desempenho Energético dos Edifícios de Habitação (DEH), Decreto-Lei n.º 101-D/2020.
2. Gonçalves, H. ; Graça, J. M. ; Conceitos Bioclimáticos para os Edifícios em Portugal, INETI, 2004.
3. NP 1037-1; Ventilação e evacuação dos produtos da combustão dos locais com aparelhos a gás, Parte 1: Edifícios de Habitação, Ventilação Natural, Lisboa, IPQ, 2000.
4. Lechner, N., Heating, Cooling, Lighting, Sustainable Design for Architects; John Wiley and Sons, 2009.
5. Regulamento de Segurança Contra Incêndio, Decreto-Lei nº220/2008 de 12 de novembro (com alterações do Decreto-Lei n.º 224/2015 de 9 de outubro) e Portaria nº1532/2008 de 29 de dezembro.

### Teaching and learning methods

Collaborative Online International Learning (COIL) mode which includes a BIP (Blended Intensive Programme).

Lectures: Seminars on specific topics; Practical tasks.

Outside of class hours: Project Based Learning (PBL) supervised by the teachers; Final project development in working groups and share of the outcomes between students.

### Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)

**Assessment methods**

- Final Written Exam - 20%
- Projects - 80% (Final project with oral presentation of the outcomes.)

**Language of instruction**

1. English
2. Portuguese, with additional English support for foreign students.

**Electronic validation**

Maria Isabel Lopes Marcelino Dias de Abreu	Flora Cristina Meireles Silva	Manuel Teixeira Brás César	José Carlos Rufino Amaro
19-10-2023	19-10-2023	19-10-2023	31-10-2023