Name of the module (English): Sustainable living environment through thermal and acoustic comfort					
Module code (UP): M22 (provisional)		**Name of the module (Portuguese):** Ambiente Construído Sustentável através dos Confortos Térmico e Acústico			
Module code (THM): IMTM (provisional)		**Name of the module (German):** Nachhaltiges Bauen durch thermischen und akustischen Komfort			
Module code (UC): M22 (provisional)		**Name of the module (Spanish):** Entorno de construcción sostenible a través de comodidades térmicas y acústicas			
Credits: 6 ECTS	**Module status:** Obligatory	**Duration:** 1 semester	**Semester:** 2	**Year:** 1	**Frequency:** Every year
Type of tuition: Classroom-based		**Workload:** 180 h	**Attendance time:** 60 h	**Self-study time:** 120 h	
Usability: Master (Degree in Sustainable Design, Construction and Management of the Built Environment)			**Classification:** Engineering / Architecture	**Teaching language:** English	
Module responsibility: Julian Kuemmel (THM)		**Lecturers:** Nuno Manuel Monteiro Ramos (FEUP)			

Description / Observations:

Up to 90% of their life people stay in buildings. Hence, they are in direct interaction with the build environment. This interaction has a significant influence on the health and well-being and has to be assessed within sustainability.

Two important parameters are the thermal and acoustic comfort. The course deals with aspects of thermal and acoustic comfort in buildings, the calculation and testing of the relevant parameters and the link of these parameters to sustainability.

Recommended Requirements

Basic knowledge about sustainable concepts in design, construction and managements of buildings and infrastructures.

Basic competences:

- Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context.
- Students are able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
- Students are able to integrate knowledge and deal with the complexity of making judgments based on information that is incomplete or limited, including reflections on the social and ethical responsibilities associated with applying their knowledge and judgments.
- Students are able to communicate their findings and the ultimate knowledge and reasons behind them to specialist and non-specialist audiences in a clear and unambiguous manner.
- Students possess the learning skills to enable them to continue studying in a largely self-directed or autonomous manner.

Transverse competences:

Within the first part of the course the students learn to understand thermal and acoustic comfort as part of sustainability. To acquire the knowledge for this more theoretical part, different ways of learning and teaching are possible. The respective way depends on the field of knowledge. In the second part the focus is on the application of the acquired knowledge. To reach this goal it is necessary to work on case studies or real projects.

Specific competences:

To be able to design buildings seeking the thermal and acoustic comfort of the occupants under sustainability criteria.

Learning outcomes:
On successful completion of this module, the students will be able:
- To understand the basic and advanced aspects of thermal and acoustic comfort as a part of sustainability.
- To calculate and measure the relevant parameters.

To assess the results and optimize rooms and buildings.

Content:
General
- Comfort aspects in acoustic and thermal buildings physics
- Acoustic and thermal comfort as a part sustainability

Thermal Comfort
- Calculation of thermal bridges
- Thermal and Hygric simulation of building components (e.g. WUFI)
- Testing of air tightness (Blower Door)
- Advanced basics and principles of infrared thermography
- Analysing the building envelop with an infrared camera

Acoustic comfort
- Sound protection in buildings
- Building room acoustics
- Principles and testing methods

Teaching methodology:
The course can be divided into two parts:
In the theoretical part the focus is on the theoretical context. The methodology will depend on the topic (e.g. classes, group work, inverted class, problem-based learning).
In the practical part the knowledge acquired will be applied to case studies (e.g. calculations, essays).
The results, the evaluation of the results and if necessary the optimization of the results will be presented in a technical report. This report will be evaluated.

Training activities:

	Number of hours	% Attendance
Theory	30	100
Classroom practice	30	100
Tutorials	5	100
Evaluation	5	100
Group work	30	0
Self-directed work	50	0

Assessment method:

	Minimum weighting	Maximum weight
Continuous classroom evaluation	0%	20%
Final written work	50%	100%
Oral presentation	0%	30%
Practical exercises	0%	20%

Grading system:

U.PORTO	20	19	18	17	16	15	14	13	12	11	10	9	...	0
Portugal	Very Good with distinction			Good with distinction		Good		Sufficient				Fail		
U.CANTABRIA	10.0	9.9	9.0	8.9	...		7.0	6.9	...		5.0	4.9	...	0.0
Spain	Sobresaliente			Notable				Aprobado				Suspenso		
THM	100	...	88	87	73	72	58	57	...		50	49	...	0
Germany	Excellent			Good with distinction		Satisfactory		Sufficient				Fail		

Bibliography:

Pinteric, M. (2017). **Building Physics – From physical principles to international Standards**, Springer Verlag, Germany.
Leimer, H.P (2016). **Bauphysik/Building Physics**, Hanser Verlag, Germany.
Hens, H. (2012). **Building Physics: Heat, Air and Moisture**, Ernst und Sohn, Germany.

Current Status: 20180427